*With the Compliments of the Editor.*

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# Annamalai University

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## Editorial

Self-expression is no less essential to a University than to an individual. The need has been felt for some time past for a publication embodying the original work done by the members of the University in order that such work might be placed permanently on record. This Journal has been started in order to meet this need. As the University has been in existence only for a short period, it is inevitable that the early numbers of the Journal should contain some articles which are largely informative in character rather than entirely original contributions to knowledge. We have no doubt, however, that with the passage of time and the proper organisation of facilities for research work at the University, the Journal will in increasing measure embody the results of original investigation and research. Meanwhile, we hope, it will serve to provide incentive and direction to research workers in various fields, while catering at the same time for the general reader.

We rely for the success of our venture upon the hearty co-operation of the members of the University and we wish to assure them that all their contributions will receive the most careful attention of the members of the Editorial Board.

The Journal will, as at present arranged, be published twice a year.

ANNAMALAI UNIVERSITY,
ANNAMALAINAGAR.
*April, 1932.*

*Editor.*

Journal
OF THE
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# The Convocation Address

DELIVERED BY

RAO BAHADUR S. E. RUNGANADHAN AVERGAL, M.A., I.E.S.,

*Vice-Chancellor of the University*

*on Tuesday, the 27th October*, 1931

*Mr. Chancellor, Mr. Pro-Chancellor, Members of the University, Ladies and Gentlemen :—*

On the occasion of the first Convocation of this University, we beg to offer to Your Excellency, our Chancellor, a most cordial welcome and to express our gratitude to you for the kind interest you continue to take in this young institution. We extend an equally hearty welcome to our Founder Pro-Chancellor, to whose munificence the University owes its existence and to whom we are deeply indebted for constant encouragement and unfailing helpfulness.

Universities have grown in the past from various beginnings and have shaped themselves under the stress of various circumstances. Some of them have grown under the shadow of the mediæval church in Europe, some have owed their existence to the patronage of kings and nobles, while others, like most modern universities in India and other parts of the world, have been founded by the State. The establishment of this, the youngest of the Indian universities, however, though it was most liberally aided by the Government of Madras, is largely due to the wisdom and generosity of a single public-spirited citizen of South India, Rajah Sir Annamalai Chettiar of Chettinad, and we all rejoice that his noble benefaction has been commemorated for all time by the association of his name with this foundation. It is appropriate to an occasion such as this, that we should recall to our minds the aims and ideals which actuated the Founder in the establishment of this University and consider to what extent the University is endeavouring to achieve those purposes.

Speaking in 1926 at the opening of the Science buildings of the old Sri Minakshi College, which now forms a part of the University, the Rajah Sahib said :—

" Since days long past, Chidambaram has been a great centre of culture in South India and has enlisted the devotion alike of her warriors and kings, saints, philosophers and poets. It has often struck me that at Chidambaram, if anywhere in South India, there is a great opportunity for working on chosen lines and to noble ends that synthesis of the great cultures of the East and the West which is the prime task of our country and of her educational institutions at this hour."

And again in the statement which he made regarding the growth of the University at the inauguration of the Senate by His Excellency in March 1930, the following sentences occur:—

" This University owes its existence to two factors, which I shall, with your leave, detail here to-day. First and foremost is the hearty and enthusiastic response that the Government of Madras has been giving to endeavours of private philanthropy and secondly the desire of the eighteen millions of Tamil-speaking people in this Presidency and abroad also to nurture a centre of learning, to give to the world the value of Tamil learning, literature and culture.

The idea of a Tamil University is as old as the College from which this University has sprung. In the early years of this decade, a motion was brought in the Senate of the Madras University that the question of starting a Tamil University be taken up for consideration. Educationists who had set their hearts on the scheme brought it now and then to the notice of the public till the idea of a linguistic university was taken up by the Andhras and worked up to success by the incorporation of the Andhra University Act in 1926. Government appointed in 1926 a Committee to examine the subject of establishing a University for the Tamil districts. The witnesses before the Committee were largely in favour of a separate University for the Tamil districts for several reasons. The Committee considered it desirable to have unitary teaching universities and as many of them as the country could afford to support in a good condition. The establishment of one such university (at Chidambaram) has been made possible by the signal response that the Government of Madras chose to give to private effort in the year 1928.

The main features of the Annamalai University Act are: (i) the provision made for research; (ii) the adequate representation of the teaching element in the various authorities of the University; (iii) the institution of a unitary teaching residential university with the concomitant advantages of an active social life among the teachers and the taught; (iv) the attempt at rehabilitating oriental culture by a special faculty of Oriental Studies; (v) the proper financial backing of the University by an endowment and the securing of sound financial expert advice by means of a Finance Committee for the infant stages of the University."

The aims and objects so clearly and eloquently set forth by the Founder are in keeping with the trend of the best educational opinion and indicate the true lines of advance in the sphere of University education in this country. The Indian University system, its organisation, policy, purposes and methods have been subjected to a great deal of criticism in recent years. The excessive emphasis laid on the examination system in University education, the conception of education as a mere economic device for qualifying men for government posts, the absence of any real intellectual training, low academic standards, the ineffectiveness and unreality of University studies owing to their lack of correlation with the social and economic life of the people, the neglect of the study of Indian art and culture, have been rightly pointed out as some of the most conspicuous defects in that system. Educational

reconstruction of a far-reaching character has, however, been undertaken within the past ten or fifteen years in order to remedy some of these evils. Not only have a number of new universities of the unitary, teaching and residential type been established but even the older affiliating and examining universities have made some provision for teaching and research. So far as the evil association of University education with Government appointments is concerned, it is worth noting that partly owing to growing unemployment among graduates, partly because of the setting up of Public Service Commissions with their own methods of recruitment, and partly also because of a change in outlook, the number of those who seek a degree merely as a passport for public service is steadily on the decline.

One of the most commendable features of recent educational reform in India has been the recognition by the universities that the extension of the domain of knowledge should be the highest goal of their effort. It will, I think, be generally admitted that too little thought has been given to this aspect of University work in the past. But within the past few years, many of our universities have begun to make provision for research and to realise both that a University will to a great extent be judged by the quality of its advanced work and that the more elementary training of the undergraduate derives no little part of its strength from the research work of its teachers and scholars. It is a matter of daily experience that teaching which consists merely in the repetition of stereotyped information tends to lose vitality and to cease to interest or inspire. A teacher's interest in his subject can only be kept fresh if he continues at the same time to be a learner. He must be constantly adding to his knowledge, either by personal research or by keeping himself abreast with the research of others. It is one of the main aims of this University to promote as far as possible original investigation and research in all the departments of study included in its faculties, in humanistic studies as well as in the field of pure science. It is hoped to achieve this purpose by the provision for the teaching staff of adequate leisure and opportunities for the prosecution of research, by suitable changes in the methods of instruction to the more advanced students, and by the institution of studentships and fellowships for postgraduate work.

Every effort is made also, wherever possible, to bring the subjects of study into close and intimate connection with the students' environment and the life of the community. There exists provision in the University for advanced teaching in the English, Samskrit and Tamil languages and literatures, in Physics, Chemistry and Mathematics and in Indian History, Politics, Indian Philosophy and Economics including co-operation, and rural economics. Several of these studies have a direct bearing on the social, economic and cultural life of the people and should equip the student with knowledge which will be of real service to the country. We have endeavoured to maintain as far as possible a balance of studies between the humanistic disciplines and modern science and between western knowledge and oriental culture. There is, however, an insistent demand that we should go further and include applied science in our scheme of studies. I am aware that there is provision in the Act for a faculty of technology and that the esteemed Founder is anxious that

something should in due time be done in this direction. While it may be freely conceded that technological studies are necessary for the industrial development of India, it is still a matter for careful consideration whether a small University like ours with its strictly limited resources would be wise in undertaking an enterprise which is not only extremely costly but which is likely to affect detrimentally the work which it has already started doing. It has to be remembered that the quality of the work turned out by a University is of far greater importance than its quantity and variety. It is much better, in view of our present resources that the University should do a few things well than that it should undertake schemes which are far beyond its financial strength. The cost of equipping a high grade technological department is so great that it seems to me that this is a matter in which all the Universities in South India may well co-operate when conditions are more favourable. Among them they may cover a fairly wide range of technological studies, each University addressing itself to those branches of study which local or other conditions determine as appropriate. This division of labour, accompanied by freedom of interchange of students between the Universities, would greatly promote both economy and efficiency. It is also to be hoped that wealthy industrial magnates and businessmen in South India will come forward with generous endowments to enable the University to achieve this object.

But the demand does not stop with technological studies alone. There are again those who urge that University education should be brought into line more and more with the actual needs of modern life by the inclusion of a variety of practical and vocational subjects. There is a danger, I admit, of Universities remaining too cloistered and academic, isolated from the main currents of life flowing round them. But while we may agree that the University system should change with the changing times and should be in conformity with the conditions and legitimate needs of the day, we should guard against the greater danger of the adoption of subjects and courses of a too narrowly utilitarian character, which have little or no cultural value. Let us never forget that the supreme function of a University is not so much to fit men for specific tasks as to train their minds and give them a vision of knowledge in its true proportions and perspective. The University bears testimony to the sovereignty of ideas and ideals in this world. It exists for the advancement of learning, the cultivation of the things of the spirit. Its vital essence is a spirit of eager and disinterested search for truth and of zeal for the increase of knowledge. In the words of a modern English poet, its function is

to build exultingly
High, and yet more high,
The knowledgeable towers above base wars
And sinful surges reaching up to lay
Dishonouring hands upon your work, and drag
From their uprightness your desires to lag
Among low places with a common gait.
That so Man's mind, not conquer'd by his clay
May sit above his fate,
Inhabiting the purpose of the stars
And trade with his Eternity.

The Founder has referred in the remarks which I have already quoted from his statement to the attempt which is being made in this University at rehabilitating oriental culture by a special faculty of Oriental Studies. This is a direction in which this University is well fitted to produce work of the utmost value and importance. South India is the home of the most ancient culture of the country. It has been said that Dravidian civilisation of a highly developed character can be traced back to the second and third millenniums before Christ. Even foreign scholars have borne testimony to the perfection with which the Tamil language has been developed into an organ for precise and subtle thought, and to the beauty and richness of the literature which is contained in it. Dravidian architecture as seen in the great shrines of Chidambaram, Conjeevaram and Madura and Dravidian music reached a high degree of development several centuries ago. South Indian history and archaeology, Dravidian literature, philosophy and art offer therefore a rich and fruitful field for exploration and critical investigation.

It is our aim that the University should play a large part in the revival and development of Oriental studies. These studies will be pursued not in a spirit of uncritical glorification of all that is old merely because it is old, but from a modern scientific point of view so that we may arrive at a just appreciation of all that is of real value and beauty in our past heritage. The study and interpretation of inscriptions and coins, of iconography and temple architecture, the publication of critical texts of the ancient classics, the collection of old vernacular manuscripts and their elucidation, the comparative study of Sanskrit and Dravidian languages for the light it may throw on the mutual influence of these great cultures in the past, the scientific study of South Indian music, and the enrichment of vernacular literatures either by translations or original compositions are some of the directions in which the University will, it is hoped, make its distinctive contribution to knowledge. I am glad to be able to announce in this connection that the University has taken over the management of the Rajah Annamalai College of Music and of the Oriental Training College and that the Founder has made a generous endowment towards their maintenance.

I have spoken so far largely of the academic aspect of University work. But a University, though first and foremost a place of learning and research, has another equally important function to fulfil. Its duty is to mould and shape the character of its students, not only by the training of the intellect but by the discipline of spirit so that they may be fitted for citizenship and may worthily fulfil their responsibilities towards society. This intellectual and moral discipline seems to me of the greatest importance at the present day when the national character is changing under the stress of the political, economic and social convulsions of our time. The residential universities are fitted by the organisation of their social and corporate life to provide this training and discipline in larger measure than universities of the older type. It is evident that if the University is to do this effectively, its teachers who live and work in close association with the students should be men of the highest character, able to exert a powerful influence for good upon the ideals and conduct of their pupils.

Provision has been made in this University for the residence of nearly 500 students in hostels and resident tutors have been appointed to give individual guidance and advice to the students. The University Union has been constituted on the model of those of the older universities in England, so that the conduct of the affairs of the Union is largely in the hands of the students themselves. So far as the health of the students is concerned, every student undergoes a medical examination annually and there is provision for the physical training of all undergraduates. In these and other ways it is our object to give an all-round education, an education of body, mind and character which will fit the students for the duties and responsibilities of life. They obtain not only in the formal studies of the University, but in the daily contact of their minds in the hostel, the Union and the debating society, and in their association for games and athletic exercises of various kinds, a training—largely their self-training—which strengthens and develops their character, gives them a wide outlook, inculcates a spirit of give and take which is the bond of society and instils into them a strong sense of duty. They are made to realise here that discipline is not opposed to freedom but is complementary to it; that the final aim of all discipline is the development of self-control and that without such self-control and intelligent self-direction, freedom would degenerate into licence. It is to be regretted that there is abroad a spirit of restlessness and disquietude, of rash and unthinking opposition to authority among young men in India to-day. I shall not go into the reasons for the prevalence of such a spirit; but I would fain hope that it is only a passing phase. The task of the universities is, however, in regard to the development of character, made doubly difficult by such a situation. But they cannot abandon their duty in this respect. They have to devise every possible means of training the rising generation by intellectual and moral discipline, for the great responsibilities which await them.

I have indicated some of the directions in which the University is endeavouring to carry out the aims of the Founder and to be of service to the country. The development of the University in all these directions will necessarily take time. It has to be remembered that this University is not only the youngest in India but the youngest of all the universities in the British Empire. I had recently the honour of representing the University at the Congress of the universities of the Empire which was held in Edinburgh. When I was there, I discovered with a due sense of humility that I represented the youngest of all the seventy universities which had sent delegates to the Congress. My humility was not, however, unmixed with a sense of exhilaration and pride when I realised that though the youngest, this University had entered into the great brotherhood of all those universities, great and small, which had sent representatives from all parts of the Empire. This very ceremony of Convocation, with all its attendant ritual so reminiscent of mediæval Europe, is a reminder to us of the catholic character of universities and indicates the brotherhood which unites men of learning throughout the world. The University is yet very young. Time has not mellowed its walls, nor can it boast of poetic groves and sculptured halls. It has yet to build up its traditions. But it has great compensations. It has entered into

possession of all the knowledge and learning of the past and the present. There are, luckily, no protective duties and no tariff barriers for the commerce of the mind. While sharing with the older universities the common purpose of conserving and extending knowledge, it can profit by their past experiences and avoid their mistakes.

It has also its great responsibilities. It should not be a mere slavish imitator of other universities, but should build up a vigorous and distinctive individuality of its own. Though it should adapt itself to modern needs and conditions, it should be uncompromising in its loyalty and devotion to learning and scholarship and maintain the highest academic standards. It should above all, unceasingly endeavour to increase the sum of human knowledge and to make that knowledge available for the benefit of mankind.

I have said already that South India has been the home of the most ancient culture of the country. The south is also the part of India which has been longest under the influence of Western civilisation and thought. Is it then unreasonable to cherish the hope that in the universities of the South more than anywhere else, there will be evolved a modern Indian culture which will combine the best elements of Western civilisation and of our inherited tradition? It is only by the combination of the science and learning of the West and all that is good and great in oriental culture that India can march along the road of progress and take her place among the nations of the world. I hope and believe that this University will, in the fullness of time, make an effective contribution towards the development of such a culture and thus render service of the highest value to the country.

*Graduates of the year,*

I congratulate you most heartily, on behalf of the University, on the success which has attended your efforts, and on your admission to the degree of Bachelor of Arts of the University. The fact that you are the first batch of candidates to be so admitted by the University, while conferring an added privilege, imposes on you a correspondingly greater responsibility. The honour and good name of your *Alma Mater* are in your keeping. The University will be largely judged by your life and conduct. Let it be your earnest endeavour, therefore, so to conduct yourselves that the fair name of your University may never be tarnished.

I spoke in the earlier part of my address of the aims and objects of the University, so that you may carry away with you a clear conception of what the University stands for and labours for and that you may help it to achieve its purposes in all possible ways. The future development of the University largely rests with you and your successors. Some of you will, I hope, return to it as its teachers. But even if you do not do so, maintain your connection with the University by visits to it either for mental and spiritual refreshment or for the renewal of old associations and friendships. Seek to interest your friends in the work of the University and build up a sound public opinion in South India which will help to support and mould the University in the future.

Whatever your position in life, none of you can escape, in these days, from some responsibility in helping to shape the destinies of your country and in influencing that current of changes, social, political and economic which is sweeping along with a quickening course. You will, I hope, by reason of the training and culture you have received at the University, bring to bear on the solution of the many problems which will face you, a wide outlook and a balanced mind, the ability to discriminate between what is merely trivial and what is important and the capacity to consider and review all relevant facts dispassionately. You will cultivate a due sense of proportion and check that intolerance which sometimes springs from the dogmatism of confident youth. In the conflicts of classes and in the struggles of parties, you will endeavour to understand the points of view of the opposing sides and give your adherence and support to the cause of truth and justice. When appeals are made to your patriotism, you will be able to judge for yourselves whether the sentiment appealed to is of a worthy or an unworthy kind. Patriotism is a great and noble virtue, but it is an emotion which is capable of being exploited for unworthy ends and ignoble purposes. See to it that you interpret your patriotism worthily and direct it along fruitful channels of service for your country. There is no greater challenge to enlightened patriotism in India to-day than the social and economic condition of the masses. The improvement of the physical well-being of the people by the spread of a knowledge of sanitation and hygiene, the provision of medical relief, the devising of methods for the economic betterment of the agricultural classes, the removal of their social disabilities, and the spread of education in the villages offer scope for the patriotic energies of hosts of our educated young men and young women.

The main part of this work of building up a healthy and prosperous nation, able to understand intelligently the world in which it lives, can only be done by ourselves. It is true that the necessity of such work is widely realised in India to-day. But what little has been done in this direction has been the expression of individual good-will, and is utterly inadequate to meet the situation. Larger organised efforts are necessary if there is to be any appreciable improvement in the condition of the masses. Education particularly is a field of service of vital importance for the whole process of making India fit for self-government. Constitutional self-government cannot become a reality until there grows up a well-informed controlling public opinion among the masses. Such a public opinion can only come into existence when education is far more widely spread than it is at present. Let the spread of knowledge among the rural masses, then, be an object of constant solicitude to you. Remove the reproach which has been cast against university graduates in the past that they have shown no sympathy with the masses of their ignorant countrymen and have done little or nothing to alleviate their condition. Even if professional duties should absorb a large part of your day, find time to engage in some form of social service, and either by the publication of suitable vernacular books or by the conduct of night schools and all forms of adult education work carry enlightenment to those who sit in darkness around you. These foundations have been

laid, these halls have been built, and these teachers of yours have been appointed not for your peculiar and personal benefit, but with the avowed purpose of benefiting, influencing and elevating through you the large numbers of those whom higher education cannot reach.

Do not forget that the key to the progress of the country lies in the education of its women. It is indeed true that South India is in advance of other parts of the country in respect of women's education, but the number of educated women is still infinitesimal compared to the general population. It is a most encouraging sign of the times that there has been a general awakening among women themselves in regard to their social disabilities and that they have begun to demand their emancipation. Do all that lies in your power to aid them in their efforts, and see that social customs and practices which have hitherto stood in the way of their development are so modified that they are free to grow in mental and moral stature and become at once the companions of your intellectual life and active partners with you in the task of building up a new India.

Communal jealousies and antagonisms are another serious hindrance to the progress of the nation. These antagonisms can only be mitigated by men of good-will and broad outlook belonging to the several communities co-operating in common tasks for the welfare of the nation. Do all that lies in your power to remove these communal and religious prejudices and to promote a spirit of enlightened citizenship.

You have to-day undertaken a solemn obligation. Not only have you promised to be good citizens, promoting the cause of morality and upholding social order and the well-being of your fellow-men, but you have also promised to conduct yourselves in daily life as becomes members of the University and to promote the cause of sound learning. I have already said something in regard to your duties to others. May I close with a word of advice as regards the duty you owe to your own intellectual and moral life? I hope your education and training here has not only given you knowledge of various kinds but has implanted in you a desire to pursue your search for further knowledge and has introduced you through your study of literature to the companionship of great thinkers and great writers. I hope you will keep up the habit of reading throughout your lives as a means not only of increasing your knowledge but of quickening your imagination and enriching the quality of your thought. There is, I am afraid, a great deal of truth in the criticism that the reading of Indian students is largely confined to their text-books and that once they have passed their examinations they give up the habit of study. I hope that this will not be true of you. The study of English has opened to you the whole realm of modern knowledge and has introduced you to a literature of unsurpassed richness and beauty. But I would not have your reading limited to English literature alone. I am not one of those who believe that the study of English necessarily implies the neglect of vernacular or Samskrit literature. It should be the aim of every educated Indian to be familiar with some of the great works contained in all these literatures, if not in

other literatures as well. For great literature has the power of edifying and elevating us, of quickening our feelings, of widening our mental horizon and of enriching our experience of life.

I hope all of you are carrying away with you in addition to the information you have gathered and the knowledge you have acquired of your several subjects of study, the vivifying influence of some great thoughts, the memory of some rich spiritual experience, the inspiration of some lofty ideal, which will enable you to translate your knowledge into action and impel you to spend yourselves in the service of your country. But ideals grow dim with the passage of time. Enthusiasm dies down and aspirations become less ardent as the heavy weight of the passing years clings about our feet. The companionship of great and wise writers will, in such moments of langour and weariness, sustain and cheer you and rekindle your enthusiasm.

May God, the Giver of every true and good gift, light your ways and bless your goings. May He lead you into the green fields of happy and successful work and by the pleasant waters of noble and unselfish service for the good of your fellowmen.

# The Teaching Profession in English Literature

BY

P. A. SUBRAMANIA AYYAR

(*Annamalai University*).

The teaching profession has been treated copiously in British letters. The learned professions have all in fact been so treated. But the schoolmaster in particular has been the theme of almost every considerable man of letters from the author of Holofernes—not to go to earlier artists—to the creator of Phillotson. Sometimes we get full length portraits; sometimes stray but telling strokes of characterisation. The sympathetic enthusiast exalts the good work of the teacher and his indispensable role in society. The indignant satirist cries out against the monster's multitudes of sins. The bantering humorist holds those sins up to ridicule. All, in a word, or almost all consider, in one way or another, this "noblest of professions and sorriest of trades" in their pages.

English Literature has in many instances painted Teaching dark. It has claimed the right of the satirical poet (as Dryden defined it [1]) to the full and has "through and through cleansed the body of the infected world" of teachers. Very nearly five out of ten literary portraits of the schoolmaster are either solemn indictments or scathing satires. The poor fellow may wince but the critic would not budge.

Describing the personal appearance of the professional teacher Literature would make him out as thoroughly contemptible. The teacher has an ugly face. He renders it more ugly by putting on peculiar expressions. Behold Dominie Sampson when he pronounces his inevitable "pro-di-gi-ous". He has an awkward figure. There is no proportion in his limbs. His gait would make him, if that were possible, even more awkward. Erasmus Holiday has an old worn-out gown—pure mediæval cut—fantastical in the making and more fantastical in the wearing. How can this man or any of his fellows of the profession inspire respect even in the Dicky Sludges? He amply incurs contempt on all hands. In company he is either made the butt of ridicule or (what is more damagingly significant) scrupulously ignored. In his class room the very children make faces at him from behind his back. Little Tom Brown's behaviour in the Vale of White Horse is not a solitary instance of the kind.

This deformed frame encloses a mind equally deformed. "Deformed" is exactly the word for it. The schoolmaster's mind, cries out the man of letters, is never formed on proper lines. He cannot, for the life of him, understand the world. He lives in a world of ideas, of abstraction, a world idealised and never real. He has his being in the

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[1] The Preface to the Fables, paragraph 7.

midst of children; children are innocence itself; and "innocence" is but another word, in the practical man's dictionary, for ignorance of the world. He is all his life absorbed, like the mathematician and mad philosopher of Laputa, in his theoretical problems and his books. Erasmus Holiday is better acquainted with all the mazes of the present and the preterite of Latin verbs, regular and irregular, than the way to Wayland Smith's cave. Dr. Strong is completely absorbed in his Greek Grammar. He has neither time nor inclination to ascertain what sort of man Jack Maldon is. His life-long estrangement from the practical world has made him incapable of knowing the Iagos from the Cassios. The very rooks of the place would cock their heads slyly, suggests Dickens, as much as to tell poor Dr. Strong that they know more worldly affairs than he.

The schoolmaster is therefore no figure in society. He cannot enliven company with one stroke of fresh wit or humour. He cannot instruct grown up humanity with any shrewd observation on the motives of human action or on the lineaments of human character. His talk can never inspire or elevate his hearers. He for ever shows off his learning and makes an insufferable bore of himself. His speeches are never-ending strings of quotations. He says nothing without citing Quintillian or Tully in his support. Never would he pause to consider whether his hearer is either inclined to listen to him or able to follow him. Holofernes would speak Latin alike to Biron and Dull. The pedant in De Quincey's *Spanish Military Nun* considers the conjugation of Latin verbs the most important item on his life's programme. His cousin Catilina, the nun flying from the authorities of her convent, seeks his protection; he explains to her the processes of declension and conjugation. These poor fellows have a pathetic faith in the supreme importance of accidence and syntax. They do not know that it does nobody any good and only exposes them to ridicule.

The worst of it is that they consider the grammar and idiom of an utterance—spoken or written—vastly more important than its subject-matter. They think it a disaster deliberately wrought to the world by an impassioned orator, if he commits a split infinitive or uses an inappropriate preposition. How would the oration, say, on Conciliation with America, have impressed a contemporary Holofernes? That pedant would have gone home from the meeting talking all the way to Nathaniel *not* on the political and economic results of conciliation as advocated by the great statesman-orator, but on the questionable grammar of the sentence: "They will appear by examining into the plans which have been proposed". To the professional schoolmaster the evils of wrong grammar are more fatal than a disastrous line of policy. The tailor in Moliere, grown connoisseur, pays more regard to the cut of a garment than its capacity to protect the wearer from wind and weather. Excellent sense of proportion, that!

How then can the schoolmaster be a safe guide to the young? The man of letters roundly denies that he is. The schoolmaster is irredeemably absorbed in his book. His vision is hopelessly confined within its covers. He cannot help therefore curbing jealously all originality and healthy exercise of imagination in the child. Dr. Busby

punishes all departure from accepted tradition with stripes administered with traditional lavishness. De Quincey complains that the schoolmaster's role among us consists simply in rendering us unable to see the wood for the trees—in sacrificing sublimer knowledge for a baser one. "In spite of all that the villain of a schoolmaster has done for the ruin of our sublimer thoughts", says this writer, "which are the thoughts of our infancy, we still believe in no such nonsense as a limited atmosphere."[1] Cowper throws the matter of this proposition into verse and tells us

"No nourishment to feed his growing mind
But conjugated verbs and nouns declined,
For such is all the mental food purveyed
By public hackneys in the schooling trade."[2]

Teachers called "public hackneys" and Teaching "the schooling trade"—how complimentary to the profession!

This does not deserve the name of knowledge—this that the "public hackney" imparts. The legislature in every country favours the teaching profession; it insists on a certificate of attendance at a school on the part of every one that claims to be literate. It thus adopts a system of Protection in favour of schools. Under a system of free trade in knowledge, many who draw pay now as teachers will find their occupation gone. The arrogant schoolmaster may be filled with the conviction that he is the possessor of the most difficult kind of knowledge. He may claim that that knowledge could hardly be obtained by any pupil by private study. He may insist that he who seeks to obtain it by private study must be instantly taught his limitations. But the presumption is patently insufferable. The late Mr. Hardy knocks it on the head with a piece of sledge-hammer-satire and shows the schoolmaster his place. Jude ("the obscure") sends a letter to Tetuphenay, a teacher in Christminster, to inquire if learning could be acquired by private study. Tetuphenay delays his answer long and then tells his correspondent that he had better not make himself ridiculous by aspiring to learning. This gives Mr. Hardy an occasion for his well-called-for satire against that presuming dunce of a teacher.

But there are authors who would have it that even this book-learning with its deplorable limitations many schoolmasters culpably lack. They simply deserve to be hounded out of the places which they unworthily fill. Dickens paints in this way, the picture of Mr. Creakle, the head-master of Salem House. The fellow knows nothing. In fact, he originally never designed himself for the schoolmaster's life. He was forced into it like many another of his profession (as Mr. Stephen Leacock would tell us) by failure elsewhere. Here is the picture in almost the very words of Dickens:—

> "The fellow knew nothing except slashing and caning. He was more ignorant than many of his own boys. He had been a hop dealer and had taken to the schooling-business after becoming bankrupt in hops."

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[1] *The English Mail Coach*; ii. The Vision of Sudden Death.

[2] Tirocinium: ll. 618-621.

Worse in this respect, as in every other, is Mr. Squeers of *Nicholas Nickleby*. This fellow is a huger cipher in point of knowledge. Look at his orthography. He writes *bottiney* for *botany*. He is literally a highway-man turned schoolmaster.

Creakle and Squeers will live for ever as instances of schoolmasters horribly ignorant of letters. But others besides novelists and satirists have drawn the portrait in like colours and with a like brush. Dr. John Brown, the distinguished educationist, is no romancer and never trifles with big issues like the ignorance of a fellow whose profession is to teach; and this Doctor has this story to tell of a schoolmaster:—

In a school in Perthshire, the annual inspector stepped into a Geography-class and asked the boys what Sheffield was noted for. Dougal Cratur—the top-boy perhaps—readily answered "Cutlery, Sir." "What does "cutlery" mean?" was the next question. Silence was the answer. But that was not the worst of the matter. From the look and actions of the teacher it was evident that he himself did not know the meaning of the word.

If, in fact, the pages of literature may be trusted, most schoolmasters are a despicable lot. They are like the mediæval mechanic, in a story told by Mr. Augustine Birrel. The mechanic was asked by his pupils why wedges cut wood; he naively answered that wedges cut wood because of an irresistible inclination in wedges to cut wood. They are like that notorious teacher of chemistry who showed his boys sulphuric acid in a yellow bottle and, being asked why sulphuric acid was yellow, indignantly asked in return why the sky was so high.

Worse even than the head is the heart of the schoolmaster. The fellow may be ignorant of the world; but one may be sure that he is never so ignorant of it as not to reach his own selfish ends by clever means. He is full of low cunning. When the school-child's parent is by, the fellow is as full of affection for the little thing as Mr. Bumble for young Oliver Twist in the presence of the inspector. But when the parent goes away, the child knows nothing but the rod and starvation. Francis, the fourth Viscount of Castlewood, accompanies young Henry Esmond to Cambridge. The tutor is all solicitude to guardian and ward alike. But the moment the Viscount leaves, the scene suddenly changes and young Harry is a man of straw.

And then, if the boy's parent is a person of consequence, the schoolmaster is meanly obsequious to the boy. If he is a poor man, woe, woe literally, unto the child. Mr. Buck, the tutor, gets a letter from Dr. Portman, the Bishop, on behalf of young Arthur Pendennis; and Arthur's extravagant ways and lofty carriage seem to argue him the owner of one of the richest estates in England. Mr. Buck therefore treats him with marked deference. But the moment the truth about Pen's riches is found out, all Buck's consideration for the young man vanishes. Such is

> the tutor rough to common men
> But honeying at the whisper of a lord.[1]

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[1] Tennyson, The Princess, 11. 114-115.

These mean fellows have likewise a mortal dread of grown up, rich or influential boys. The dread is in exact proportion to the heartless tyranny they exercise over little, weak or poor boys. Creakle is inexpressibly afraid of Steerforth while to Traddles he is simply a brutal tyrant. The villain would humour Steerforth by any means—even by impiously dismissing poor Mr. Mell, a teacher in the school. He would add a lie unto that fault and say that he did it to save the honour of Salem House.

In the matter of exacting money, they beat Shylock thoroughly hollow. They get money for the boarding and tuition of the child. But the little fellow feeds worse than a dog in the school. The tuition the child gets does not deserve to be called such, though the sum charged is vastly more than what would be warranted by really efficient schooling. Then the fond parent sends much money as pocket allowance to the young one. But the luckless little fellow sees not a farthing of it all. Squeers, nobly backed up by Mrs. Squeers, gets large sums of money from parents. But the only thing his pupils learn in Dotheboys Hall is the very useful art of living on nothing a year, not to speak of the even more useful art of living as few days as possible in a world which never seems to have had patience with them. Mr. and Mrs. Squeers! They justify more than all others in the teaching line, Cowper's damaging statement about the profession :

> Much zeal in virtue's cause all teachers boast,
> Though motives of mere lucre sway the most ! [1]

It is perilous to commit children to the care of these monsters. Some would not, some could not and the vast majority do not execute the trust at all worthily. Why then send children to schools ? Young Tullivers and Wakems would be all right, if they had nothing to do with the Stellings. The products of schools do no one any credit ;

> Great lawyers, lawyers without study made
> Churchmen in whose esteem their best employ
> Is odious, and their wages all their joy,
> . . . . . . . . .
> Fops at all corners, lady-like in mien,
> Civited fellows, smelt ere, they are seen,
> . . . . . . . . .
> All these and more like these were bred at schools.[2]

The above picture of the schoolmaster is no compliment to the profession. But Literature tells also of another side to the picture. The ranks of teachers are not exclusively composed of fools and knaves. To every portrait of a teacher of the questionable sort presented above, can be opposed a portrait, pleasing and brilliant enough to vindicate the profession. Dominie Sampson is indeed ugly in features and awkward in speech and behaviour. He fills all, from Meg Merrilles to the

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[1] Tirocinium : ll. 516–517.
[2] *Ib.* : ll. 822–840.

laundress, with contempt. But his is a noble heart and vindicates the trust and affection of Bertram of Ellangowan. Mr. Mell is certainly "poor as a church-mouse". But

> In misery's darkest cavern known
> His ready help is ever nigh.

The non-teacher may pique himself on his superior knowledge of the world and hold the teacher in contempt. But Dr. Strong's estimate, and not Mr. Wickham's, of Mrs. Strong's purity proves after all the correct one. The lawyer, with his "shrewd suspicions" and "his prudent admonitions" has to accept defeat. "Dr. Strong", says Dickens, "was the kindest of men with a simple faith in him that might have touched the stone hearts of the very urns upon the wall". And if Cowper advises the parent not to send the child to school but to do the teaching himself, here is Dickens assuring us that the children that passed through the hands of Dr. Strong could face the world with every assurance of success:

> We all felt (asserts David Copperfield) we had a part in the management of the place and in sustaining its character and its dignity. Hence we became warmly attached to it—I am sure, I did for one, and I never knew in all my time of any other boy being otherwise—and learnt with a goodwill, desiring to do it credit. We had noble games out of hours, and plenty of liberty; but even then, as I remember, we were well spoken of in the town and rarely did any disgrace by our appearance or manner to the reputation of Dr. Strong and Dr. Strong's boys.

Not all the parents in the world with their parental interest in children could thus send out boys into the world made fit to face its realities and solve its problems as one Dr. Strong with his infectious goodness and enthusiasm could. If you run your eyes through the pages of Literature ever so cursorily, thousands of Dr. Strongs will stand out to glorify the profession. What Charles Lamb says of Mr. Boyer at Christ's Hospital is known to almost every schoolboy. Mr. Boyer, "rabid pedant" as he was, managed to "manufacture" great men out of little boys and fill Anglo-Saxondom with them to an extent and in a manner Anglo-Saxondom must be proud of and grateful for. The portrait of Dr. Arnold of Rugby, not in Findlay's biography of that great and distinguished teacher, but in that common schoolboy's book, *Tom-Brown's Schooldays*, is an undying monument to the schoolmaster's glory and gives the lie direct to the ignorant world's convenient assumption[1] that the teacher thinks more of his pay than of his duties. This Dr. Arnold was ever "with all his heart and soul and strength striving against whatever was mean and unmanly and unrighteous in our little world". He was "the true sort of captain for a boy's army". He "won his way to the hearts of the great mass of those on whom he left his mark and made them first believe in him and then in his Master". Speaking of this famous head-master, "He was a goodly

[1] Gibbon says so explicitly in the *Autobiography*.

teacher", you cry out, in the vein of Horatio. "He was a goodly man; take him for all in all", I rejoin, in that of Hamlet. *He* could satisfy, as his great son justly claimed, "the gaunt and taciturn host", and what was more, could make his weak and erring fellowmen likewise satisfy him.

Dr. Strong and Dr. Arnold, verily Heroes as Teachers! But heroes as they are, they have one fault in them: they are faultless supermen according to these literary portraits. Would not a hero be more loveable and worshipful just for a touch of the frailty of the flesh in him—just for a touch, that is, of humanity? The greatest of the novelists of our own century knew he would be and portrayed his Hero-Teacher, Mr. Phillotson, as a real human being exposed to temptations, often yielding to them, struggling hard against them and on the whole overcoming them. This Phillotson leaves a certain place to take work in another and the children in the former cry. He is as passionately attached to his pupils as they are attached to him. His figure recalls to our minds that of Mr. Marton, the poor pedagogue in *OLD CURIOSITY SHOP*, who identifies himself with his scholars, who weeps bitterly for the death of the top-boy of his class, and who, in the midst of obloquy and contempt and insult and material privation, is

> As some tall cliff that lifts its awful form,
> Swells from the vale and midway leaves the storm.

For,

> Though round its breast the rolling clouds are spread,
> Eternal sunshine settles on its head.

Phillotson's brothers in the profession think him eccentric and call him his own worst enemy because he declines to keep his wife enslaved to him body and soul. But the literary critic must hasten to make them see that Phillotson is eccentric only in the sense that he disdains to take mean advantage of tradition; and that he is his own worst enemy only because he follows what he thinks right "in the scorn of consequence." Oxford and Cambridge have been often stigmatised as "nests of commonplace schoolmasters whose characteristic is timid obsequiousness to tradition"; if only those time-honoured seats of learning were manned by Phillotsons, how free they would be from this blame and how "great centres of high and fearless thought" in reality they would prove!

Literature has thus considered both sides of the question. It has done "even handed justice." On the one hand, the schoolmaster is ugly in features, awkward in movements, contemptible for his ignorance, repulsive in his assumption of airs, despicably mean in his devices to make money; he does not know his own job; he has no true knowledge to impart; he is a dealer in shoddy ware and merits nothing but scorn. But on the other hand, there are thousands in the profession who are full of knowledge and of the power to transmit it; who are wise of head and noble of heart; who are truly philanthropic in their desire to propagate light and heroically self-sacrificing in throwing away all rosy chances in life and embracing this "sorriest of trades"; who create an atmosphere wherever they go, congenial to the growth of mental and moral health and but for whom the stability and progress of society

would be scarcely possible. A great Indian national man of letters tells us that the pupil draws his knowledge from the preceptor exactly as the living world draws its vitality from the sun.[1] A great English national man of letters addresses the schoolmaster in language that makes him out the most useful member of the commonwealth.

> Sir, I praise the Lord for you, and so my parishioners; for their sons are all well tutored by you and their daughters profit very greatly under you; you are a good member of the commonwealth.[2]

But for these great teachers who wring eulogy from all quarters, willing and unwilling, but for the Arnolds and Strongs, Philistinism which a great Arnold loudly bewailed and warred with would come to stay with us. Culture would vanish and noble ideals yield place universally to sordid ends. Critics of Teaching in and outside Literature refuse to recognise this great role of the teacher in society and reckon it already undue grace shown to him if he is just tolerated. But to them Literature offers a needful corrective. If they insist that the teacher is good for nothing except administering stripes to the pupil, Newman assures us that in the noble shades of the Attican schools everything was "influence" and nothing was "discipline". If they still remain unconvinced, let us refer them to the ancient gurukulas of this land and the Sabarmatis of modern days. If Mr. Stephen Leacock tells us that fellows found useless in other walks of life take to Teaching, as did Mr. Creakle, let us refer him to Adam Smith who assures us "that almost all the great writers of Greece had been engaged in the business of education."[3] And if the hostile critic contends that the teacher is ill-equipped for his task and cannot give his pupil his money's worth, the poet proves this contention a myth when he dwells on the pathos of the condition of Leonard the schoolmaster:

> And deeply skilled in science and arts,
> On vulgar lads he wastes superior parts—
> Alas! what grief that feeling mind sustains,
> In guiding hands and stirring torpid brains.
> He whose proud mind from pole to pole will move
> And view the wonders of the world above,
> Who thinks and reasons strongly—hard his fate,
> Confined for ever to the pen and slate:
> True, he submits, and when the long dull day
> Has slowly passed in weary tasks away
> To other worlds with cheerful view he looks,
> And parts the night between repose and books.
> Amid his labours, he has sometimes tried
> To turn a little from his cares aside;
> Pope, Milton, Dryden with delight has seized,
> His soul engaged and of his trouble eased.[4]

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[1] Raghuvamsa—Cano V., 4.

[2] Love's Labours Lost, Act IV, Sc. ii, 11. 68. 71,

[3] Quoted by J. A. St. John in a foot-note on page 469, Vol. 3 of Milton's works.

[4] Crabbe, The Borough: Letter XXIV; Schools.

Let it also be borne in mind that Milton and Johnson and Carlyle and a host of others whose names humanity will never willingly let die belonged to the schoolmaster's profession. Who will now accuse the teacher of questionable mental equipment? There are of course many who would infer the teacher's inefficiency or lack of sense of duty solely from the pupil's ignorance. But, Boswell's account of Johnson's Edial School falsifies the contention. Johnson's pupils confidently stated, at the end of a year's course of instruction in English History, that Jesus Christ abolished the monasteries. But is this necessarily a commentary on Johnson's work with them? We know the author of the *Rambler* and of *Rasselas*. We know his contribution to thought and letters. We know that his table-talk has immortalised him as an English national *Institution*. His case puts it beyond the shadow of doubt that the pupil's ignorance or his failure in an examination is at best a dubious test of the teacher's qualifications and that, tested by that alone, the teacher is "more sinned against than sinning." It is consoling, however, to reflect that, even tested according to this standard, Teaching has in thousands of instances acquitted itself nobly and that, while Literature is coming more and more impartially to recognise the share of the teacher in the advancement of civilization, History (recent and current) is backing up Literature by affording such shining examples of genuine intellectual greatness and moral worth as the late Mr. Gokhale, President Wilson and our own Rt. Hon'ble Sastri.

# Village Organisation in the Madras Presidency at the Time of the Introduction of British Rule

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## I

The Hindu polity of South India cherished, to a great extent, local ties and local strength. Maratha administrative ideas which were later superimposed, retained, in a number of phases, the old village unit, but helped in the replacement of the ancient indigenous officers by their own officials; and they also helped in the partial Hinduising of the administrative terms in those regions where Muhammadan influence had been strong. The village community was the vital basis of the district administration; and it comprised a number of hereditary officials. In the more democratically constituted villages, the proprietary members were all deemed to be equal and looked upon themselves as masters of the village, of all the lands attached to it and of the other inhabitants thereof, the common affairs being managed, not by a headman holding his office from government or other external authority, but by a committee of the proprietors of the village. The officials of government did not usually interfere directly in the business of administration and treated with the community "as with a body corporate." The village had a machinery of its own for distributing the burdens, both of taxation and of service.

In the larger villages of this type, there were usually several divisions of the community, each of which had some share in the *panchayat* or governing board, consisting, on an average, of perhaps half a dozen members. The members of the board had power and authority only as representatives of the general body. They wielded great personal influence; and disputes were, frequently, voluntarily referred to them. But they did not attempt to punish other proprietors; nor did they presume to offer decisions in disputes not voluntarily referred to them.

Cultivation in these villages was not, however, carried on in common. Every village was divided into a certain number of fixed portions, termed ploughs; but a plough was "rather like an algebraical symbol to express a fixed share, than a literal plough". The arable land was divided into a number of ploughs; the individual holdings were expressed in terms of ploughs; and all imposts, whether of government, or required for meeting common expenses, were assessed at so much a plough. It was the practice for lands to be redistributed annually or terminally; but, in course of time, the holdings generally came to be fixed. Common right notions survived to an extent that enabled members to claim periodical remeasurements and readjustments of holdings and payments and to rectify inequalities and boundary shiftings which might have gradually arisen. The grazing ground of each village was common to

The English conquest of the *Sarkars* took place in 1758-59. The Nizam's formal confirmation of their possession came in 1766; and it was only three years later, that the Company's servants were appointed to directly manage it. The *zamindars* kept retainers of three kinds, *viz*: *peons* paid in money; *mocassa peons* paid by grants of land, subject to a low quit-rent, and the *manovarti peons*, being tenants of a higher order, bound to bring their adherents into the field when required. Government attributed to the *zamindars* the character of tributary chiefs at first, but soon found out the mistake and the fallacy of such an assumption. The village communities, whether in the *zamindari* or *havelli* lands, retained their old organisation of the *Patel*, the *Karnam* who kept registers and accounts of cultivation, the boundary-man, the watchers of tanks and channels, the *Talayari* and the *Toti*, all of whom enjoyed rent-free lands known as *maniyams*. Of course, both *zamindars* and the renters of revenue in the *havelli* lands, usurped rights, including *rasooms* and perquisites from the cultivators; while the *zamindars* had usurped judicial and other powers formerly enjoyed by the *sarkar* officials like the *amaldars* and the *faujdars*.

## IV

The evils of the *poligar* system of rule were very pronounced in the Ceded Districts, acquired in 1800 by treaty with the Nizam and placed under Major (afterwards Sir Thomas) Munro, their first and greatest Principal Collector. The headmen of villages were petty tyrants in themselves; and the chief cultivators, abetted by accountants, had become bandits in many cases.[1] At first, the Directors recommended the adoption of gentle measures towards the *poligars* so that they might be reconciled to British rule and characterised Munro's stern attitude towards them as disingenuous. And Munro had to demonstrate that they were not entitled to gentle measures on ground either of their ancient rights or of their recent conduct, and gave an account of their claims and rights, as he understood them. His first settlement of the land was made on the *mozawar* basis, each village to pay a lump assessment, the headmen being severally responsible for the assessment of their individual villages and jointly for the whole of the district. The second settlement was on the *kulwar* or *ryotwar* basis and was finished by 1805. Munro boldly condemned Government's proposal to revert to a *zamindari* settlement, the *zamindars* or proprietors to pay a fixed sum for each village for a term of years, and reiterated his arguments for a *ryotwar* arrangement with modifications to be introduced if required.[2] The practice of the cultivators was to change holdings annually or periodically and to occupy fallow or waste land and thus allow the previously cultivated land to have rest.

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[1] *Vide* the letter of Wm. Thackeray, Collector of the Adoni Division, dated September 8, 1807 which describes the *poligars* as always fighting with the troops of the *sarkar*, while the *patels* and *karnams* had become bandits.

[2] The Reports of Munro dated November 30, 1806, of July 29, 1807, and August 15, 1807—*vide The Fifth Report* Vol. II. pp. 413-34 and Arbuthnot's *Sir Thomas Munro*, Vol. I. App. 6.

## V

In Malabar the early British administrators asserted repeatedly that the village system did not exist; the existing *Nāduvāḻis* and *Dēsavāḻis* being commandants of the *nād* or country and the *dēsam* or parish—each division having to contribute its allotted quota of Nayars which it was required to bring into the field. The chieftains held their dignities as hereditary in their respective families. In 1817, Sir Thomas Munro, then Commissioner for the framing of Judicial and Police Regulations, paid a visit to Malabar to satisfy himself as to the real character of these communities. He came to the conclusion that Malabar had been, from the earliest times, divided into districts and villages, the limits of which had remained unchanged; that these were under hereditary chiefs and that the village was called the *dēsam* by which title it is still commonly known. The *tara*[1] formed a small republic as it were, represented by their *kārnavar* or elders and presented a degree of resemblance to the village community of the Tamil districts. The *dēsam* and the *tara* were not coterminous. The *nād* or country was a congeries of *taras* or village republics. And the *kūttam* or assembly of the *nad* was a representative body possessing considerable powers which could set at naught, when occasion arose, even the authority of the Raja and his ministers.[2]

The *tara* organisation was attempted to be modified into the *hobali* (*Kan: hobali = division*) system, or subordinate direct establishments, under the Company's rule, the *taras* being enlarged for this purpose. It, however, only added one more link to the chain of officials between the Collector and the village officials. It was abolished later on and replaced by the existing *amsam* system. The Special Commissioner who created the new arrangement in 1822–23, was at great trouble to choose for the headship of the *amsams*, the most influential of the *dēsavāḻis* under the ancient system. The *dēsavāḻis* selected were not generally the most important of the chiefs of all the *dèsams* comprised in the *amsams*; and hence, the rights of the other *dēsavaḻis* had to be carefully preserved. The new scheme ignored and failed to utilise the civil organisation of the *karnāvars* of the *taras*; and hence there was effected one more breach with the past. Each *amsam* came to be equipped with an *adhikari* or headman, an accountant or writer, called *menōn* and two or more *kōlkārs* (club-men or peons) who thus became the local representatives of Government.[3]

## VI

In the southern districts which were under the rule of the Nayaks, of Madura, a considerable portion of the country had passed into the hands of the *poligars*; and the *palayam* organisation, though the most

[1] Munro thought that the name *tara* was applied by the officials of Hyder Ali and Tipu Sultan to the territorial units which they tried to keep alive as villages with hereditary heads.

[2] *Vide* the Tellicherry Factory Diary quoted by Logan in his *Malabar Manual*; p. 90.

[3] See p. 35 of J. Matthai's *Village Government in British India.*

practical solution of the difficulties in the days of the Nayaks,[1] and extended even into the Mysore and the Carnatic regions, had come to be unworkable and to result in the most severe oppression of the people. The Report of Mr. Lushington, the Collector of the Poligar Peshkash in the Southern Districts, dated 20th August, 1799, describes the various fees and money-collections made by them, the claims of the *poligars* over lands in the *sarkar* villages which they presumed to hold rent-free and their frequent ejection of ryots from lands of which they themselves held the *inam* rights.

The Company, when it got control of the Carnatic, by treaty with the Nawab in 1792, regarded the *poligars* as usurpers of authority. A Report of the Madras Board of Revenue on this subject, made in 1797, was later supplemented by a Minute of Lord Hobart, the Governor. The Court of Directors agreed with the views and suggestions of their Governor, in their Despatch of 5th June, 1799. The Collectors of the Southern and Western Poligar Countries reported fully on their military establishments and the mode of their maintenance, as well as on their revenue and other resources and the nature and variety of their impositions on the people. The expedition of Major Bannerman against the Tinnevelly *Poligars* and the subsequent campaign which was ended in 1801, were followed by the proclamation issued by Lord Clive, the Governor, dated 1st December, 1801, which suppressed the use of all weapons of defence, and promised the *poligars* a general amnesty and a permanent assessment on the principles of the *zamindari* tenure. Dr. Caldwell, writing in 1881, congratulated the Government on the fact of the *poligar* having been changed into a *zamindar*, in "nature as well as in name"[2] and also on the peacefulness that has settled upon the descendants of the fierce retainers of the *poligars.* The double fees exacted by the Poligars, as district-watchers and village-watchers, for *dēsha kāvaḷ* and *stalam kāval* respectively, interwove them and their retainers into the establishments of the villages. The *poligars* had so encroached upon and assumed the rights of the village *talayaris* and watch-men, that more than 80 per cent of the villages in the Tinnevelly District had come under their influence and their *peons* had superseded the *talayaris* or retained them on condition of receiving from them a share of their perquisites. Thus, the older institution of the village *kaval* came to be absorbed in most cases into the *poligar* system. The comparatively newer institution of the *desa kāval* (district watching fees) originated either from a grant of the ruler or from the voluntary action of the villagers, who, being unable to protect themselves, submitted to such contributions. These came to be levied by the *poligars* from defenceless villages as the price of forbearing to plunder them.

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[1] The system was the solution of Visvanatha Nayak and his Dalavai, Aryanatha, for the difficult problem of reconciling the conflicting interests of all the classes of the people; its object being to enrich and ennoble the most powerful of each class and at the same time to secure their and their descendants' allegiance. The existence of the Poligars, as a class, dates from the commencement of the Nayak rule at Madura. (*cir,* 1550), though some, like the Setupathi of Ramnad, went back to earlier times.

[2] *A Political and General History of the District of Tinnevelly* (p. 219).

They consisted of payments of money, grain, plough or cattle and various other articles. The fees made on account of police duties were exclusive of other assessments to which the inhabitants of the neighbouring *sarkar* villages were subject as well, under various pretexts, such as hunting, *batta*, marriage expenses and other presents.[1]

The effect of the introduction of British administration on village organisation in South India has been to introduce the practice of paying village servants in cash and to convert them, so far as the surviving portion was concerned, into the servants of the Government organisation and thus sever them from their connection, either with the village community or with the *zamindar* or *poligar*. The hereditary principle was accepted, in a large measure, in the selection of the chief officials of the village. The *panchayats* came to be largely dropped out of use, though Munro tried to revive them by the Madras Regulations of 1816. A large amount of matter was taken over from local initiative and direction and vested in the bureaucratic machinery. From this state of affairs, there has begun, recently, a healthy revulsion by which Government has been largely promoting schemes of decentralisation in village and local matters.

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[1] For details, *vide* The Fifth Report (Ed. of 1866) Vol. II (Madras Presidency pp. 89-90).

# The Chidambaram Temple

BY

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## I

The numerous temples all over South India are a constant attraction to the study of local history. The materials for writing the history of the South Indian temples are to be found in (1) Current traditions and legends some of which are interlarded with miracles in the local *puranas*, (2) Inscriptions and (3) Tamil Literature. The Chidambaram Temple is rich in epigraphs. The inscriptions of the Temple which have been engraved on its walls relate to several South Indian Rulers—Pallava, Chola, Pandya and Vijayanagar Kings. Unfortunately, no early epigraphs are found. As the earlier structures of the temple seem to have undergone renovation, the records so far deciphered do not take us much earlier. Though the antiquity of the temple is attested by archæological evidence as well as by references in early Tamil literature, no contemporary epigraphic material is found in the Temple. Again as the full texts of all the inscriptions have not been published, we have to rely on the summaries of the inscriptions given in the Annual Epigraphical Reports. The earliest Chola records in the Chidambaram Temple are those of Rajendra Chola I, dated 24th year of his reign, and several records of Kulottuṅga I, the earliest being the 9th, and the latest the 47th year of his reign. There are several inscriptions of Vikrama-Chola, and of the later Cholas, notably Kulottuṅga III.

The inscriptions of the early Pandyas are not found in the Temple, but there are several inscriptions of the Mediæval Pandyas—Sundara Pandya I, Vira Pandya, and Vikrama Pandya. Though the history of the Temple goes back to the Pallava times, no inscriptions relating to early Pallavas are found in the Temple. But there are several inscriptions of the great Medieval chieftain, Kopperunjingadeva, in the Nataraja and the 'Tillai Amman' Temples in Chidambaram. The inscriptions of the Hindu dynasty of Vijayanagar are found all over South Arcot, and there are epigraphs in the temple relating to the Vijayanagar rulers of the earlier and later dynasties.

Some of the epigraphs of the Temple bear an historical introduction and they are so far valuable in corroborating the historical achievements of the rulers derived from other sources. Most of the inscriptions which refer to later Chola Kings simply register grants of land for flower gardens ; in some of them gifts of land are made for maintaining worship, offerings, festivals in the temple, and particularly the special food offering known as '*Pavāḍai*'. The Chidambaram Temple does not seem to possess many old copper-plate grants. Sewell refers to some copper-plate

grants.[1] Hultzsch, in one of his early Epigraphical Reports, says that he saw 2 copper-plate grants which were dated in Saka 1621 and 1725, but they do not seem to be of much importance.

Few temples in South India have such a rich literary tradition as the Chidambaram Temple. The 'stala puranas' of which there are many varieties are of no use for historical purposes, but they are interesting in enabling us to understand something of the religious symbolism of the temple. The 'Koil Puranam' written by Umapathi Sivachariyar of Koṟṟavangudi a medieval schoolman of the early 13th century, begins with 'Vyaghrapada Sargam' and ends with 'Tiruvizha Sargam'. The *Chidambara Puranam* of Paranjoti Munivar who lived about A. D. 1518, belongs to much later date. The earliest references to Siṟṟambalam are found in the hymns of the three poet-saints—Appar, Sambandar and Sundaramurthi. *Dēvāram* or the sacred hymns deserve critical study as genuine works of considerable importance to the students of South Indian history. The evidence furnished by the poet-saints may be taken as true as their writings have come down to us without much change in their reading. The religious fervour and ecstasy with which these poets have sung the glories of the temple point to the fact that the temple has been regarded as a sacred institution even long before what is called the hymnal period in Tamil Literature. (A. D. 600–A.D. 950). Another important work in Tamil Literature which deals with the Temple is Mannikavaṣagar's *Tiruvaçagam*. According to tradition, *Tiruvaçagam* was recited in the temple itself. There are 25 poems dealing exclusively with Tillai. *Tiruchiṟṟambala Kovai* was also composed in Chidambaram by Mannikavaṣagar.

To the student of South Indian history, Sekkilar's *Periyapuranam* is of considerable interest and importance. The contents of this work, though not the final redaction of it, date from the time before the great Chola King, Rājarāja. The *Periyapuranam* which is the history of the 63 Saiva Saints mentions the most ancient Saiva temples and it is therefore helpful in determining the antiquity of these temples. This quaint but valuable work was composed during the reign of the Chola King Anapáya or Kulōttuṅga-Chôladeva but the subject matter of the book is more ancient than the time of the great Rājarāja whose inscriptions record that he set up images of a number of those 63 saints in the Tanjore temple which was founded by him. As regards Sekkilar's *Periyapurānam* we can in general depend on its testimony, as the author spared no pains in collecting all the available information of his time, but there is also in it a good deal that is mythological.

The literary references that we find in Tamil Literature help us to some extent in interpreting the purpose of Siva's dance. Of such literature, we may mention *Uṇmai Vilakkam*, Tirumular's *Tirūmantram*, *Chidambara Mummaṇi Kovai*.

## II

The ancient name of Chidambaram is Tillai. It is known by this name both in early literature and in epigraphs. It was at first a forest of Tillai (*Excoecaria Agallocha*) trees. The other names by which Chidam-

[1] Sewell lists of Antiquities, Vol. 2, p. 9.

baram is referred to both in Tamil Literature and in epigraphs are Puliyur, Perumbaṟṟapuliyur, and Siṟṟambalam. Siṟṟambalam has been interpreted by the Government Epigraphist as 'the small temple as distinguished from *Pèrambalam*'. On the other hand Siṟṟambalam is to be taken to mean as the place of 'chit' i.e. divine knowledge.[1] The name Vyāghrapura, which is a Sanskrit rendering of the Tamil name Puliyur, occurs in an inscription (No. 515 of 1922) of Rajendra Chola III at Tirukaṇṇapuram which refers to the king as a worshipper at the divine lotus-feet of Kanakasabhāpati at Vyāghrapura. The temple was so famous in ancient times that the *Dēvāram* hymnists simply refer to it as 'Koyil' (i.e. the Temple), and in some of the inscriptions, it is simply referred to as Tirukkōyil. Chidambaram, according to available inscriptions, seems to have had at first as many as 14 hamlets.

## III

According to tradition, the temple was of divine origin, but was repaired and enlarged by Hiranyavarma in the 6th century. Apart from this tradition, it is with the help of epigraphic and monumental evidence that we have to sketch the growth and expansion of the Temple from the time of its foundation. The Siva Temple at Chidambaram is an ancient structure and contains many inscriptions attributable to Pallava, Chola and Pandya kings. It is not a temple built almost in its entirety like the temple at Tanjore. The main shrine is a small building which has attained to great sanctity; and court-yards, gopuras and other exterior structures have been added to it by succeeding kings in such a manner that the original small central shrine cannot be seen from outside. Special sanctity attaches to the 5 *sabhas* or halls—the Chit Sabha, the Kanaka Sabha, the Nritta Sabha, the Deva Sabha and the Raja Sabha.

The most ancient parts of the temple seem to be the small shrine of Nataraja and the Mūlasthana right opposite to the main east gopura of the temple.[2] The shrine of Nataraja is built of wood which is clear proof of its great antiquity. The Kanaka Sabha or the golden hall includes the shrine of Nataraja and the secret chamber called '*Rahasya*' where there is no image or linga but a string of 'vilva' leaves and the explanation is that it is the abode of Sīva in his *akasa* or ethereal form. The Chit Sabha and Kanaka Sabha are enclosed by a wall which separates it from the Mūlasthana and this wall which bears on it some of the earliest records of Vikrama-Chola, dated 3rd year of his reign

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1 "சிற்பரமா மம்பரமாந்திருச் சிற்றம்பலம்" (Koilpuranam).

"'*Chit*' means the subtile essence of the deity, filling all space. Being connected with the concrete term 'ambaram', the meaning of the term may be the essence of the spiritual symbol, 'spiritual soul'. *Ecambara* is a name of Siva, but Chitambara ignores visible form and this term was given to the first Saiva fane in South India having a sanctuary open to the heavens and without any idol" (Taylor Mss. Vol. I, p. 659).

2 The following stanza in Koilpuranam by Umapathi Sivacharya refers to the fact that the Chit Sabha is to the south of the Mūlasthana shrine of the temple.

"நாடரு நடுவிணுடி நலங்கிளர் தில்லை நேர்போய்க்
கூடுமக் கதனின் மூலக் குறியுள ததற்குத் தென்னர்
மாடுறு மறைகள் காணு மன்றுமம்பல மொன்றுண்டக்
காடுதெ மென்று மென்று மென்னை யாளுடைய வைவன்"

known in 3 inscriptions as Vikrama-Ṡoḷan-Tirumaligai and Kulottunga-Soḷan-Tirumaligai in 4 others. The first Prākārā of the Temple thus surrounding the central Shrine of Nataraja might have been the work of Vikrama-Chola, the son and successor of Kulottunga I. The second prākāra wall which encloses the Mūlasthāna-Shrine is also called Vikrama-Ṡolan-Tirumaligai. From one of the inscriptions[1] it is inferred that the Mūlasthana-Shrine is known as 'Edirambalam'.

All gifts of and made to the temple have been engraved on the temple walls. Up to the time of Vikrama-Chola all transactions made on behalf of the Temple were made in the name of Chaṇḍesvara, but subsequently they were registered in the name of the temple priests and trustees, either jointly or severally. This may be taken to refer to the time when the Mūlasthana-Shrine and the image of Chaṇḍeṡvara by its side was considered to be the *sanctum sanctorum* of the temple. That provision was made for the singing of *Devaram* in the Mūlasthāna-Shrine is attested by one of the epigraphs of the temple (No. 341 of 1913). The prominence given to the Nataraja-Shrine in later inscriptions accounts also for the disappearance of Chaṇḍeṡvara and the substitution, in his place, of one of the temple committee. This change suggests the reason why, at the present day, the Dikshitars of Chidambaram have come to be the practical owners of the temple. In the days of Kulottunga III, the order of the king or of his officers which was written by his royal secretary (Tirumandira Olai) was generally addressed to the executive members of the temple assembly, the temple priests, the managing committees and the supervisors of the temple. A large number of Kulottunga III's officers are mentioned in the inscriptions.

The original title-deeds of lands granted to the temple and other connected documents such as the resolution of the village assembly to make the land rent-free, on receiving some fixed amount from the donor (290 of 1913) or to distribute the due tax on other assessed lands of the village (280 of 1913) had to be deposited in safe custody in a room or office of the temple called '*Tirukkai-ōṭṭi-pandaram*' together with sale-deeds if any. The little shrine in the inner enclosure i.e., the Nritta Sabha, is also one of the oldest structures of the temple; and from an architectural point of view, it is the most beautiful structure in the whole temple. In the words of Fergusson, it is 'a porch of 56 pillars about 8 feet high, most delicately carved resting on a stylobate, ornamented with dancing figures more graceful and more elegantly executed than any of their class in South India. At the sides are wheels and horses, the whole being intended to represent a car'.

According to Fergusson (*Indian and Eastern Architecture*, p. 350) the inner enclosure, as we find it to-day, may be old as the 10th century and the Temple of Parvati, and other shrines in the outer enclosures belong to a later age. The great gopuras of the Temple seem to have been built by different kings at different periods. That the northern gopura was built by Krishnadeva-Raya is evident from his own inscriptions in the temple.[2] Another epigraph of Krishnadeva-Raya (374 of

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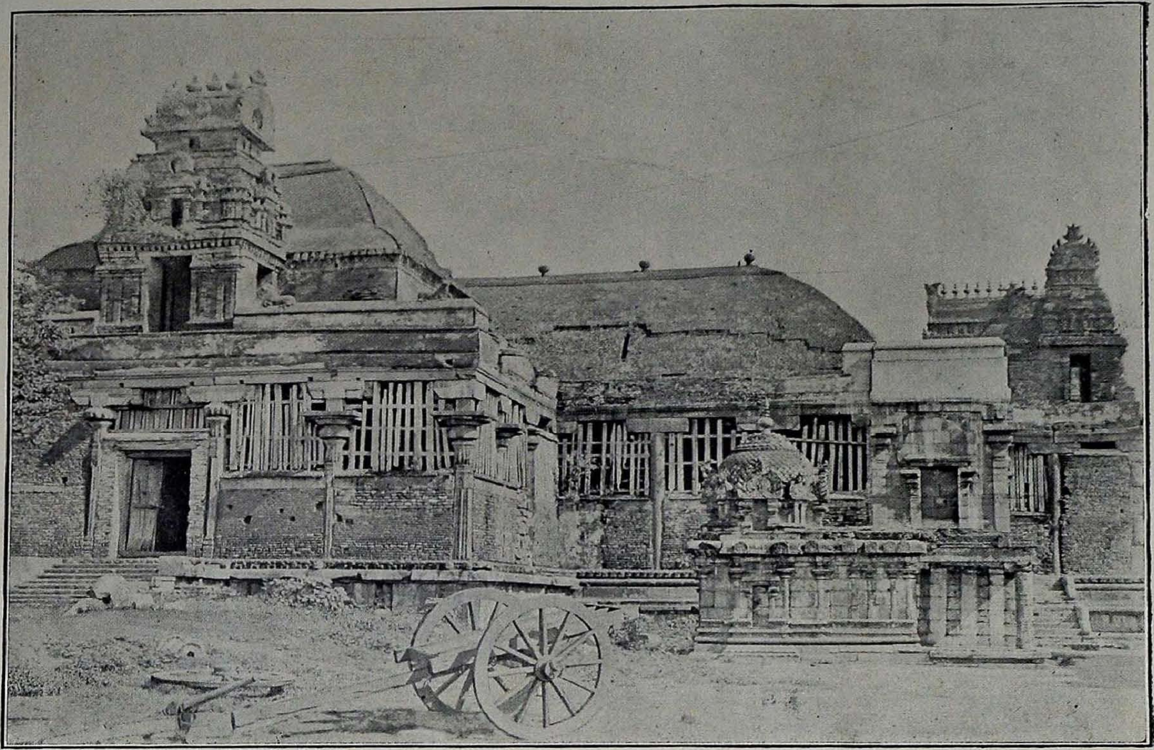
[1] No. 290 of 1913.

[2] No. 371 of 1913.



The '1000-Pillared Mantapam'

1913) says that while the other *gōpuras* of the temple were the work of crowned kings, the northern *gopura* was the work of God Himself, a poetic way of saying that the northern tower was the most beautiful. The eastern gopura seems to have been built by the Pallava chief, Kopperunjinadeva, and rebuilt by the great educational benefactor, Conjeevaram Pachaiyappa Mudaliar (1754–1794).[1]

That the southern gopura must have been the work of a Pandya king may be inferred from the Pandya crest—the fish—on the cross stone connecting the right and left niches of the tower. The 1000-pillared maṇḍapam, it is inferred, was built sometime between 1595 and 1685 A.D. (*Madras Journal* Vol. VIII, No. XX, p. 15—1838).

The earliest literary references to the Karpagavinayakar Temple adjoining the western 'gopuram' are found in the Koilpuranam.[2]

The temple at Chidambaram contains a number of Sanskrit and Tamil inscriptions. These inscriptions mention the names of some of the Pallava, Pandya, Chola and Vijayanagara Kings and also record some of the achievements of these rulers. They are therefore useful either in throwing fresh light or in corroborating the conclusions derived from other sources. Though the names of some of the kings are repeatedly mentioned in several inscriptions, there are 3 inscriptions which give us the names of 3 Chōla Princesses—Kundavai, Ammangai, and Madurantaki. The first of these princesses is called "Rajarajan Kundavai, the younger sister of Kulottuṅga-Sora-deva (or Rajendra Sora-deva)" and has been identified with Kundava[3], the daughter of the eastern Chalukya Rajaraja I (1022–1063) and the younger sister of Kulottuṅga Chola-deva I; the second princess is referred to as, "Ammangai, the daughter of Kulottuṅga-Sora-deva"[4] and is identified with Ammangadevi who married the eastern Chalukya King Rajaraja I.; the third Princess is referred to as "Madurantaki, the younger sister of our lord (Kulottuṅga-Sora-deva".[5]

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[1] Hamilton in his *History of Hindustan* observes that the eastern gopura was repaired by a devout widow, the mother-in-law of Pachaiyappa Mudaliar of Kanchipuram at the expense of 50,000 Pagodas.

The stone-images of both Pachaiyappa and the lady are in the niches of the southern wall of the gateway. Refer to the "Select Papers, Speeches and Poems connected with Pachaiyappa Mudaliar" edited by V. Krishnamachariar (1892), wherein Mahavidvan Sabapathi Mudaliar has sung of the rebuilding of the Gopura by Pachaiyappa in the last years of his life.

" தாபதர் போற்றுந் தில்லைத்தற்பரனார் தங்கோயிற்
கோபுரங் கீழ்த்திசையிற் கோலமுடன்—சீர்பெறவே
கட்டுவித்தானெங்கள் காஞ்சிநகர்ப் பச்சையப்ப................. "

[2] The following stanzas are found in the Koilpuranam of Umapathi Sivacharya and we may therefore take these references to confirm the existence of the Karpagavinayakar Temple and the western 'gopuram' long before the 13th century.

" தூய
தற்ப கற் றெழு வாழணி கோபுரர்
கற்பகத்தனி யானை கழல்களே "

. . . . . . . .

" மன்னோங்க நடமாடு மன்றோங்கு மதிற்குடபாற்
பொன்னோங்கன் முன்னோங்கும் பொற்பமர் கற்பகம்போற்றி " ... (Koilpuranam)

[3] Ep. Ind. Vol. IV, p. 302, Ind. Ant. Vol. XIV p. 50.

[4] S. I. Inscriptions Vol. IV. No. 226.

[5] No. 117 of 1888.

One of the famous Chola Kings was Parantaka I., who ruled with various titles from A.D. 907–947, '48 A.D. According to the Leyden Grant[1] Parantaka covered the Śiva temple at Chidambaram with gold; and the credit for this work is also claimed for Kundavai.[2] Parantaka I's covering with gold the small hall (*Dabhrasabhā*, which is a translation of the Tamil Sirrambalam) of Śiva at Chidambaram is referred to in verse 53 of the Tiruvalangadu Plates.[3] Though tolerant of all religions in his dominions, he is known to have followed the Saiva creed, as he utilised all the booty he acquired in his wars in covering with gold the temple at Chidambaram. But there are no inscriptions of Parantaka I in the temple itself to commemorate these achievements which are claimed for him.

Some of the inscriptions of the temple are of considerable interest, as they give us something more than mere names. One of the famous kings of the Chōla dynasty was the Chalukya-Chola Kulottuṅga I who ascended the throne about A. D. 1070. He is known to us from the Chellur Plates of his grandson, Kulottuṅga II, (according to which he reigned for 49 years[4] and from the Chellur plates of his son Virā-Chôla; we also learn something about Kulottuṅga I from the Tamil poem *Kalingattu-Parani* composed in his honour. But the chief sources for the history of Kulottuṅga I are his own inscriptions. There are the Sanskrit inscriptions at Chidambaram[5] and a Tamil inscription without historical introduction refering to the 44th year of his reign.[6] The Sanskrit inscription consists of 2 verses. The 1st verse says that the king burnt the fort of Korgâra (i.e. Kôṭṭâru, near Cape Comorin) and defeated the Kēraḷas, and according to the 2nd verse, the king erected a pillar of victory on a peak of the Sahyadri Mountains. The references in these inscriptions are in spite of their exaggeration, of some historical value. We know that the parents of Kulottuṅga I were the Eastern Chalukya King Rajaraja I and Ammaṅga-dêvî. He had a younger sister, named Kundavi, after her grandmother which is known from a Chidambaram inscription.[7] Kulottuṅga I had various surnames. One of his surnames, according to the Chellûr and Pithaparum Plates, is Rajanarayana. In *Kalingattu-Parani*, he is known as Kulottuṅga-Chôla, Karikâla-chôla, Abhaya, Jayadhara.[8] The last surname Jayadhara is also found in an inscription at Chidambaram.[9]

We know that Kulottuṅga I was succeeded by his son Vikrama-Chôla. The date of his accession has been a subject of dispute. According to Kielhorn, he was crowned king in A.D. 1118, but during the latter part of the reign of Kulottuṅga I, he seems to have been practically

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1 Archæological Survey, S. India, Vol. IV. p. 208.
2 Ep. Ind., Vol. V. p. 105.
3 Archæological Survey Report 1904–05, p. 134.
4 Ind. Antiq. Vol. XIV. pp. 51–55.
5 Ep. Ind. Vol. V. pp. 103–104, S. I. Inscriptions, Vol. I, p. 168 H No. 115 of 1888.
6 Ep. Ind. Vol. V, p. 105.
7 Ep. Ind. Vol. 5, p. 105.
8 Kalingattu-Parani canto xi-verse 68 *and passim*, published by V. Kanakasabhai in Ind. Antiquary Vol. XIX. p. 329 ff.
9 Ep. Ind. Vol. 5. p. 105.

the ruler. The Kulottuṅga-Solan-Ulā, a Tamil poem composed in honour of Kulottuṅga II, says that Kulottuṅga II covered the Nataraja Temple at Chidambaram with gold. The Rājarājan-Ulā another Tamil work composed in honour of Rajaraja II, the son of Kulottuṅga, also attributes the gilding of the temple to Kulottuṅga II.

An inscription from Tiruppālaivaṉam (No. 349 of 1928–29) refers to Tribhuvana Chakravartin Kulottuṅga-Chôla who covered with gold the temple at Perambalam (Chidambaram). Another record from the same place (No. 315) begins with the words, '*Tirupperambalam-pon-Vēinda-ruliya*' Rajakesarivarman. Both these inscriptions are attributed to Kulottuṅga-Chôla II whose claim to have covered with gold the temple at Chidambaram is known to us through other epigraphic[1] and literary references.

On the other hand, there are two inscriptions of Vikrama-Chôla[2] which attribute this pious work to him. Whether Vikrama-Chôla or Kulottuṅga II had the better right to claim to himself the gilding of the temple is a question to which no conclusive answer can be given. Perhaps as in the case of the conquest of Kaliṅga, the work of covering the temple with gold was accomplished by the son during the lifetime of the father.

Thus the work of covering the temple with gold is claimed by various kings Parantaka I, Vikrama-chôla, and Kulottuṅga II. But, as a matter of fact, some of the Devaram hymns which belong to a much earlier date refer to the temple as செம்பொன்னிலில் எழுதி மேய்ந்த சிற்றம்பலம், பொன்னம்பலம். But what is more important is that the way in which this event is recorded in Tamil literature and epigraphical records serves to establish the succession of the Chôla kings during this period.

Recent researches have brought to light the doings of the remarkable Chôla chieftain, Naralokavira, in the days of Kulottuṅga I and his son Vikrama-Chôla.[3] He is described by many names and titles in his inscriptions such as Kalingaraja, Sabhanartaka, Manavatara, Arulakara, Naralokavira, etc. There are about a dozen inscriptions bearing on the life and work of Naralokaviran, and one of his inscriptions is to be found in Chidambaram. While most of his inscriptions make it appear that he was a mighty warrior, the Chidambaram inscription shows that he used his great position and influence in the state in the service of religion. The most notable of his structures in Chidambaram on behalf of his master Vikrama-Chôladeva was the hall with a hundred pillars.

Another Chôla king for whose reign the inscriptions of the Temple are helpful is Kulottuṅga III (A. D. 1178–1216). The latest date of Kulottuṅga III is the 39th year in a manuscript at Chidambaram.[4] Kulottuṅga III is known by other names.—Virarajendra-Śola-dêva was one of his names and we learn from inscriptions of the temple that he

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[1] Annual Report for Epigraphy (1907).

[2] 165 of 1894, 82 of 1895.

[3] A. R. E. 1922, p. 115.
K. A. N. Sastri—Studies in Chola History and Administration.

[4] S. I. Inscriptions Vol. III Part I (1899), p. 43.

was called Virarajendra-dêva.[1] The records of the reign of Kulottuṅga III are numerous. Four inscriptions[2] of the Chidambaram temple relating to Kulottuṅga III have been deciphered. Of these, two relate to the 5th year, and two to the 9th and 11th year respectively. All these inscriptions have a historical introduction, but the historical introduction of the inscriptions of the 5th year does not contain any statement of historical interest. Inscriptions of the 9th and 11th years contain statements of historical interest. The inscription of the 9th year relates 'how Kulottuṅga III assisted Vikrama Pâṇḍya against the son of Virā Pâṇḍya, defeated the Marava army, drove the Siṅhalese army into the sea, took Madurai (Madura) from Vira-Pâṇḍya and bestowed it on Vikrama Pâṇḍya. The inscription of the 11th year refers ' to the defeat of the son of Vira-Pâṇḍya and to the bestowal of Kûdal on Vikrama-Páṇḍya and adds that Vira-Pâṇḍya revolted again, but that Kulottuṅga III ' took his crowned head '. Chidambaram is referred to in this inscription as Perumbaṟṟa-puliyûr in Râjâdhirajâu Vaḷanadhan and the temple as Tiruchchiṟṟam-balam-udaiyâr. According to the information in some of the epigraphs about the building operations of Kulottuṅga III,[3] we learn that ' he built the *mukha maṇḍapa* of Sabhāpati and *gōpura* of the shrine of the goddess Goviṅdraja and the enclosing verandha (*Prākara-harmya*)'. These references are to the Nataraja Temple at Chidambaram where the king must have built the ' mukhamaṇḍapa ', the ' gōpura ' of the shrine of the goddess, Sivakami-Ammaṉ, and the verandah enclosing the central shrine. Kulottuṅga III is also described as an unequalled devotee (*êkhabhakta*) of the God at Chidambaram.

There are no epigraphs in the temple relating to the early Pandyas. All the available epigraphs relate to the mediāeval Pandyas. There are a number of epigraphs which record gifts to the temple and refer to the victories over the Hoysala (Sômêsvara) Ganda-gôpa, the Kakatiya king (Ganapati), and the kings of Cuttack, Malabar and Ceylon.[4] The value of these historical references lies in the fact that they help us to identify this king as Jatâvarman Sundara Pâṇḍya I., who ruled from A.D. 1251-1261. The eastern and western main 'gōpuras' of the temple contain some epigraphs[5] referring to the achievements of a certain Sundara Paṇḍya who has been identified with Jatávarman Sundara Paṇḍya I. One of these inscriptions consists of 2 verses, the 1st verse referring to the conquest of the Chôla by the Paṇḍya king and the second verse mentions Kādavarkōṉ (Pallava king) and the Paṇḍya king Sundarattoḷ. Two other inscriptions (Nos. 340 and 361 of 1913) praise the military prowess of Sundara Māṟaṉ (i.e. Sundara Pāṇḍya who defeated the Teluṅgas at Mudugur. One of these inscriptions (No. 354 of 1913) consists of three Tamil verses describing the glory of Sundara Pâṇḍya who conquered the King of Veṇaḍu (i.e. Travancore), the Teluṅgas and the Koṅgu country and killed Gaṇḍa-gōpala. The value of these inscriptions of Sundara Paṇḍya I consists in confirming some

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[1] S. I. Inscriptions Vol. III. p. 205.

[2] 121 of 1888, 122 of 1888, 457 of 1902, 458 of 1902.

[3] 190, 191 and 192 of 1908.

[4] 170, 171, 172, 173, 176 to 186 of 1892.

[5] 332, 340, and 361 of 1913.

of the achievements claimed for that ruler as a great warrior. Some of the epigraphs of the temple[1] refer to Sundara Paṇḍya I's weighing himself against gold; and, he is also credited with having built a golden hall at Chidambaram (S. I. Inscriptions Texts Vol. IV. Nos. 627 and 630).

Another epigraph referring to Jatavarman Sundara Paṇḍya I[2] records the agreement by the trustees of the Tiruvananteśvarasvamin and Nayanār Maṇṇaṇār Temples situated between the Kollidam and Veḷḷāru rivers that certain dues on lands in the village belonging to the Temple at Chidambaram should be remitted and that the amount should be rateably enhanced on the remaining lands in the village. The popularity of this great king, Sundara Paṇḍya I, was commemorated by the inauguration of several religious and civic charities. A record from Chidambaram[3] registers the establishment of a grove and an avenue of cocoanut trees planted on either side of it for the recreation and habitation of the people.

There are a few epigraphs of Jatâvarman Vira-Paṇḍya which refer to him as one who took Īlam (Ceylon), Koṅgu and the Sola-maṇḍalam (i.e. the Chola country), and who having conquered the powerful (Chôla) king was pleased to perform the anointment of heroes and victors at Perumbarra Puliyur (i.e. Chidambaram)[4] and this king is perhaps identical with the Vira-Paṇḍya whose initial date according to Kielhorn, is A.D. 1253.

We also learn from other sources that Jatāvarman Vira-Paṇḍya encamped at Chidambaram to collect tribute from his subordinates and to perform the 'Abhiśêka'. There are several epigraphs of Vikrama-Paṇḍya in Chidambaram which serve to set in a clearer light the doings of that ruler by confirming the conclusions derived from other sources. He is referred to by his titles Bhuvanika Vira and Korkai Kavala, and of having conquered the Venadu (i.e. Travancore) king at Podiyil. One of the epigraphs (329 of 1913) is of particular interest. It consists of six verses in Tamil of which five refer to a battle fought at Chidambaram (apparently on the banks of Veḷḷaru, near Chidambaram) by a certain Muṇaiyan, Valliyaṉ Adittaṉ, chief of Panaisèyyar on behalf of the Paṇḍya (Miṇavaṉ) against the Chōla (Vaḷavan). The author of the poem was Tāynalla-Perumal Munaiyadaraiyan *alias* Bhuvanikavira Toṇḍaimaṉ. Though the historical details claimed by these epigraphs may be a highly overdrawn picture, yet there is a dim historic truth underlying these references.

There are six epigraphs in the Chidambaram temple[5] referring to Maṛavarman Vira Paṇḍya and they suggest the possibility of this king being the successor of Maṛavarman Vikrama-Paṇḍya and also the contemporary of Ravivarman Kulaśèkhara.

From the latter half of the 12th century, the chôla power became more and more weak and there were also signs of decay among the Paṇḍyas. The times were thus highly favourable for feudatories to rise into prominence. For instance, the Sambuvarayans who held a subordinate position

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1 338 and 363 of 1913.

2 535 of 1920.

3 546 of 1919.

4 131 of 1907, 437 of 1917.
Refer 192 of 1914 of Jatâvarman Vira-Paṇḍya.

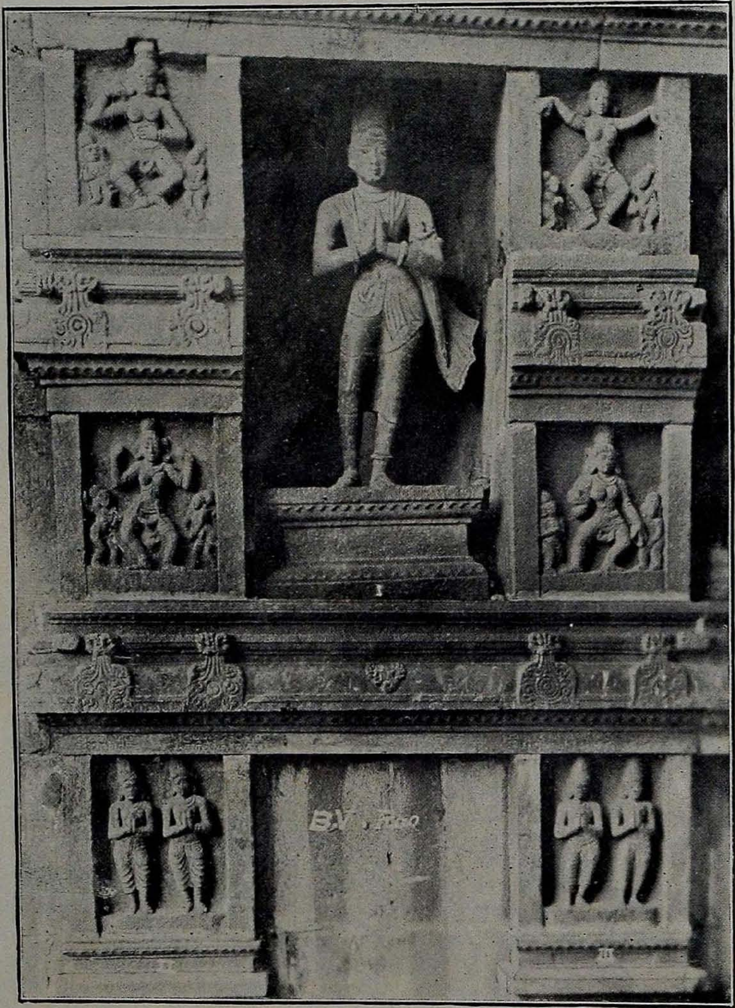
5 279, 320, 328, 351 and 386 of 1913.

under the Chôlas and had done signal service to them under 4 successive sovereigns Rājarāja II, Rājadhirāja II, Kulottuṅga III and Rājarāja III now began to assert themselves. There are numerous inscriptions of the later Pallava kings who held sway in S. Arcot. Most prominent among the chiefs who took advantage of the weakness of the Chôlas in the 13th century was Kopperunjingadeva. He asserted his independence and ruled for about 30 years, and it is evident from some epigraphs that his dominion extended southward beyond the Coleroon into the Tanjore District. Some of Kopperunjingadeva's epigraphs are found in the Nataraja Temple and the Tillai Amman Temple in Chidambaram. These epigraphs mention some of his chief officers, notably Perumāl Piḷḷai *alias* Śoḷakōṉ, Teṉṉavaṉ Brahmādhirājan, Jayatunga-Pallavarayan, and Tillai Ambalappallavarayan. The earliest references to the local Tillai Amman Temple are to be found in the inscriptions of Kopperunjingdeva and one of the epigraphs is of particular interest as it refers to "the Temple (Srikoil) of the Pidāri called Tiruchirrambala Mākāli" (312 of 1913). Mr. Krishna Sastri has pointed out that, according to an inscription at Tripurantaka (Kurnool District), a certain king, Maharaja Sinha, built the eastern *Gōpura* of the Nataraja Temple and that this king was evidently Kopperunjingadeva. Three pillars[1] for the merit of his master—Perunjingadeva—one on the west entrance into the second prâkâra of the Temple, one on the *Gopura* at the main entrance into the Sivakami Amman shrine, and one now found on the door-post of a new entrance close to the eastern *Gōpura*—were set up by Śoḷakōṉ for the merit of his master. Kopperunjinga's donations to the temple and his devotion to the god at Chidambaram are evidenced by the epigraphs as well as by his title, *Kanakasabhapati-Sabha Sarvakarya-Sarvakala-Nirvahakah.*[2] It may be incidentally noted that according to an epigraph in modern Tamil the eastern *Gopura* of the temple was repaired and an *Agrahara* was founded by Suppammal, the mother-in-law of Pachaiyappa Mudaliar of Kanchipuram. That a part of the South Arcot district came into the temporary possession of a ruler of Kerala, Kulaśekhara, in the early part of the 14th century is evident from one of the epigraphs in the Chidambaram temple.

Inscriptions of the Hindu dynasty of Vijayanagar are found all over South Arcot which formed a part of Tondaimandalam. There are several epigraphs in the temple relating to Vijayanagara kings of the earlier and later dynasties. The earliest record is that of Dévarâya II, dated Ś. 1349 (i.e. A. D. 1428). An inscription[3] on the north wall of the Kaṟpaga Vinayaka shrine, in the western *Gopura* of the temple records the fact that 'the King ordered certain irregularities in temples and temple lands to be set right'. The full text is worth quoting as it discloses the lines on which the temples were supported, and their affairs were regulated by the king. The King's order ran as follows.

"As we have been informed by the *Mahesvaras* and *Marudavanāchchivan* that the king's officers in the villages belonging to the temples are unjustly collecting the taxes called *Kanikkai*, *Arasuperu*, *Karanakkar*,

[1] 321, 324, 325 of 1913.
[2] 418 of 1922, 286 of 1921, 197 of 1905, 419 of 1893.
[3] 376 of 1913. A. R. E. 1914, p. 97.



Krishnadeva Raya

*viseshadayam, ulamanji*, etc., representing these to be dues payable to the palace; that the villagers taking up on mortgage the lands purchased, presented or otherwise owned by the temples, stubbornly refuse to give back those lands to the temples and that as a consequence the temple tenants have abandoned the villages causing thereby the stoppage of worship in these temples, we order that the taxes mentioned above shall no longer be collected, the only payable tax, however, being the *Sūlavarippon* ; that the worship, etc. in your temples shall be conducted in future under the direction of the said Marudavaṉachchivaṉ and that temple lands shall in no case be let out on (long) lease, nor shall they be assigned to anyone as tax-free hereditary property, free gift or *bhaṭṭavritti*."

Kṛishṇa-deva-Raya (1509–1530), who is known to us as one of the most famous of Vijayanagara kings, has left a monument of his greatness in the Chidambaram temple. The northern *Gōpura* of the temple was built by him in memory of his victories in the north[1] (Ś 1438 i.e. about A.D. 1516). One of these records registers the fact that Kṛishṇadeva 'after having started on a campaign against' Simhādri-Pottunūru, planted a pillar of victory there, and returning thence, he paid a visit to Ponnambalam (i.e. Chidambaram), worshipped the God and built the northern *Gōpura* of the temple.

Another epigraph on the eastern *Gōpura* of the temple records the grant (Ś. 1443 i.e. A.D. 1522) of the village of Chidambaranathapuram to the temple by Maṅgaraśan who is presumed to be identical with Taraṇikka Mangarasayyan, who was the Viceroy of Kṛishṇa-deva-raya in Tiruvaḍi-rājya (South Arcot district).[2]

The Gōvindarāja shrine in the temple has a long and eventful history. There are literary and epigraphical references. It is mentioned by the Aḻvārs, Kulasekhara and Tirumangai-Mannan. The poet-saint Maṇikkavasagar refers to it in his famous '*Tiruchchirrambalakovai*' (Stanza 86). The Kulottuṅga-Śolan-Ulā and the Rājarājan-Ulā composed in honour of Kulottuṅga II and Rājarāja II respectively refer to the tradition that Kulottuṅga II, a bigoted Saivite ordered the image of Govindaraja to be thrown into the sea. The earliest epigraphical reference in the temple is a record of the Vijayanagara King, Achyutayya Mahārāya (dated Ś 1461 i.e. A.D. 1539) who ordered that the image of Tillai-Govindarajaperumal at Perumbaṟṟa-Puliyūr might be set up according to the ritual of Vaikhānasa Sūtra and granted 500 *pon* which was the income of 4 villages for the upkeep of daily worship.[3] On the other hand, according to the Vaishṇaviṭe *Guruparambaras*, the *Chitrakutā* was destroyed in the time of Ramanuja (1016–17 A.D.–1137 A.D.), the image of Govindaraja was removed by the Vaishnavas to Tirupati and consecrated there by Ramanuja. Kulottuṅga II ruled from 1135 to 1146 and jointly with Vikrama-Chōla from 1123 to 1135. So the

[1] 174 and 175 of 1892, 371 and 374 of 1913. For Texts of these Inscriptions, *Vide* S. I. Inscriptions Vol. IV, Nos. 622 and 623.

[2] 333 of 1913.

[3] 272 of 1913.

removal of the Vishnu shrine from Chidambaram and its consecration at Lower Tirupati should have taken place somewhere between 1123 and 1135. The next literary reference to the shrine is in the time of Vedāntā Deśika. According to the *Guruparambara*, Vedānta-Deśika took advantage of an internal commotion in Chidambaram to make Gopannāraya of Gingee to re-establish the image about 1370. On the other hand, the *Prapannāmritam* attributes this honour to Mahāchārya or Doḍḍācharya of Sholinghur and of Rama Raya of 'Chandragiri' whom it supposes wrongly to be a king and successor of Kṛishṇa-deva-Rāya. The present inscription would support the version of *Prapannamritām* if Rama Raya is taken to be a mistake for Achyuta Raya. If not, we should have to suppose that after Achyuta Rāya there was another Saivite attempt to remove the idol and a final restoration of it by Mahachārya late in the 16th century.[1] Another epigraph, an unfinished record of the Vijayanagara King, Achyutadēva-Mahārāya (1530–1542) records the re-consecration of Govindarajasvamin at *Chitrakūta* by the same ruler.[2]

An epigraph on a slab in the Paśupatiśvara temple at Tiruvēshkalam records the grant of that village, to the Chidambaram temple by Achchutappa-Nāyaka, son of Siṟu-Sevappa-Nāyaka for the merit of Tirumalai-rajayaṉ (i.e. the Karṇāṭa king, Tirumala I).

A few epigraphs of the Vijayanagara kings—Ranga II and Venkata I (1586–1614) of the Karṇāṭa dynasty are found in the Chidambaram temple[3] and one of their chiefs *viz.* Vaiyappa-Krishṇappa-Koṇḍama-Nāyakkar who is frequently mentioned in these inscriptions presented several villages to the temple and also declared tax-free all the villages owned by the temple from early times. Muthu-Kṛishṇappa-Nāyaka, son of Koṇḍama-Nāyaka is said to have made some repairs to the temple during the time of Veṅkata I.

One of the epigraphs of the temple relating to the reign of the Vijayanagara King—Ranga VI, is of particular interest.[4] It is dated Śaka 1565 (i.e. A.D. 1643) and records that the King repaired the big Maṇḍapa in front of the Tillai Govīndarajaswami shrine, the *gōpura* of the shrine, the *vimanas* of the Goddesses, Puṇḍarikavalli-Nāchiyar and Sūḍikoḍutta-Nāchiyar and the *Maṇḍapa* in front of the shrine of Tiruvaḻi-Aḻvān.

Before we proceed to deal with the later vicissitudes of the temple in the Carnatic wars of the 18th century, it is desirable to refer to a few things which are of great interest to the student of village economics and administration. That the revenue survey of the Tamil country was made from time to time by some of the kings is known to us from early epigraphs.[5] An inscription of the Chidambaram temple[6] also confirms this fact by referring to a land survey in the 16th year of Kulottuṅga I. The existence of a land survey committee (nilam-aḻavupaḍipperumakkal) of the village assembly of Perumbaṟṟa-puliyur

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[1] Ins. S. Dts., P. 162, No. 1.
[2] 1 of 1915, Ep. Rep. 1915, p. 81.
[3] 348, 349, 359, 369 of 1913.
[4] 271 of 1913.
[5] 199 of 1917, 285 of 1918.
[6] 317 of 1913.

which functioned in respect of land revenue assessment of temple lands is attested by one of the Chidambaram epigraphs.[1] Another epigraph[2] gives minute fractions of *velis* and land measures and is therefore of great interest to the student of economic history.

There are several epigraphs referring to the remission of assessments on lands granted to the temple. We learn that the village assembly (*mula parushaiyar*) dealt at times with the temple lands.[3] Original documents, pertaining to gifts of land made to the temple were preserved in the treasury of the temple and engraved on its walls.[4] The royal order which made known these arrangements is known as 'Tirumandira-Olai'[5], the village accountants are known as 'Varikkuru Sevyar'.[6] Eight different classes of land are referred in one of the Chidambaram inscriptions (No. 262 of 1913). All the details concerning land such as its extent, ownership, assessment, classification, etc., were noted in village and temple registers by clerks specially appointed for the purpose. Registry in village books, and enjoyment were considered essential to establish one's ownership in any property.

One of the inscriptions of Sundara Paṇḍyadeva on the south wall of the 1st *prakara* of the Nataraja temple at Chidambaram[7] gives interesting details of the founding of an agrahāra named Vikrama-Pāṇḍya Chaturvēdimaṅgalam on the western side of Perumpaṟṟapuliyur and its presentation to 108 learned Brahmins. (For the maintenance of these and of other village accessories (*grāmaparikara*) the village Rajāśikhāmani-nallur *alias* Puliyaṅgudi, on the western bank of Poṉṉeri was acquired and granted being divided into 147¾ shares (*paṅgu*). The inscription is worth quoting in full as it is one of the few inscriptions relating to the foundation of a new village.

The village granted was called Vikrama-Pāṇdya-Chaturvedimaṅgalam evidently after the name of an unknown brother or father (*nāyanār*) of Sundara-Pāṇḍya. In the centre of it was also established the temple of Vikrama-Pāṇḍyēśvara similarly designated. The village was intended to accommodate primarily 108 Brāhmaṇas among whom were many well-versed in *vēdas* and *śāstras* and able to expound the same. Four *vēlis* of land were purchased for the village site and included within it the temple premises, the house sites of the 108 Brāhmanas mentioned above, of men whoever in charge of the village library (*Sarasvati-bhaṇḍārattāi*) and of other village servants (*panimakkal*). In purchasing the land with its trees, wells, paths, channels (?), embankments, indicating land-divisions (*bhājāśraya*) and all other benefits, the rights and privileges of the old tenants and title-holders were completely bought up. The right of way was secured for the Brāhmanas to walk to the tank Kāvarkulam, everyday, for the purpose of performing the *Sandhyāvandana* prayers. Land for grazing the cattle was also provided for. Also for the maintenance of the 108 Brahmin families and others were

[1] 262 of 1913.
[2] 457 of 1902.
[3] 288 and 296 of 1913.
[4] 298, 299, 306 and 309 of 1913.
[5] 299, 310, 311 of 1913.
[6] 311 of 1913.
[7] 277 of 1913.

*acquired* 117$\frac{3}{4}$ *vēlis* of land in the village of Rājasikhāmaṇinallur *alias* Puḷiyaṅguḍi. The Brāhmanas evidently received each a full *vēli* of land. The following other vṛittis were also settled:—teachers of the *Vēdas, 3*; teachers of the *Sūtras* 1, two doctors 1$\frac{3}{4}$; *ambadayas* ? $\frac{1}{2}$; village accountant $\frac{1}{2}$; drummer $\frac{1}{4}$; potter $\frac{1}{4}$; blacksmith $\frac{1}{4}$; carpenter $\frac{1}{2}$; goldsmith $\frac{1}{4}$; iraṅkolli $\frac{3}{8}$; barber $\frac{3}{4}$; washerman $\frac{1}{4}$; village watchman (pāḍi-kappāṉ) $\frac{3}{4}$; and the village servant (Veṭṭiyān) $\frac{1}{8}$. Of the *natta* land outside the *agrahāra*, 'Brahmaṇ quarter', three parts were set apart for *Vellān-Kāniyālar* and the remainder for other professionals (?). The fruit trees, gardens, ponds, water-pits, grazing grounds, irrigation channels, uncultivable waste, embankments (?) of fields and pathways included in the village site were made over (to the donees) as per customary law. All taxes were excused but it was stipulated that from the 14th year of the king 500 *kalam* of superior paddy, was to be measured out every year to the temple at Chidambaram for conducting the *Sandi*, Ellāndalaiaṉ-Perumāl Sandi, and that all lands which belonged to temples (Tirunāmattuk kaṇi) must be demarcated by stones marked with the trident'.[1]

The later struggles in the Carnatic between the English and the French for supremacy do not concern us here except for one important event connected with the Chidambaram temple.[2] The temple was used as a fort first in 1760 and later in 1780. The French took Chidambaram in 1753 and held it during the war. It surrendered to Major Monson on 12th April 1760. In 1760 Colonel Coote after defeating Lally at Wandiwash and driving him back into Pondicherry possessed himself without much trouble of Cuddalore and Chidambaram previously to taking Pondicherry which fell in January 1761.

In 1781 Coote was defeated in a night attack on the fortified pagoda then garrisoned by Hyder. The attacking party under Coote's personal direction were repulsed with considerable loss after forcing their way through two of the three enclosures of the western gateway of the temple. It was during this disturbed period that Nataraja was removed from his shrine by the Dikshitars and taken over to Tiruvarur (in the Tanjore district) for safety. An inscription in *grantha* character, in the form of a '*sloka*' in the 1000-pillared 'mantapam' refers to this fact and says that it was in the year Saka 1695, Kali 4874 (in the month of Masi *Kṛishnapatcha, mula nakshatra, thriyothasi thithi*) that Nataraja came back to Chitsabha from Tiruvarur.

(*To be continued.*)

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[1] A. R. E. 1914, part II, para 18.

[2] Cambridge. *War in India*, p. 131. Orme's History Vol. III, (4th Ed.) gives the plan.

# On the Group of the Miquel-Clifford Configuration

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**1.** Let $C_1$ and $C_2$ be two straight lines in a plane. We denote their intersection by $C_{12}$ and call it the *Miquel Point* of the 2-line. Three lines $C_1$, $C_2$, $C_3$ taken in two's determine three such Miquel Points $C_{23}$, $C_{31}$, $C_{12}$ which lie on a circle $C_{123}$, the *Clifford Circle* of the 3-line. With four lines $C_1$, $C_2$, $C_3$, $C_4$ we shall have four Clifford Circles $C_{234}$, $C_{341}$, $C_{412}$, $C_{123}$ which are concurrent at the focus of the parabola touching the four lines. This is the Miquel Point $C_{1234}$ of the four-line, the notation being so framed that

(i) an even number (including zero) of suffixes indicates a point and an odd number a circle; ... (1. 1)

and (ii) the suffixes of incident elements—a circle and a point—agree except for one additional suffix in the case of one of them. (1. 2)

We shall, throughout this paper regard the order of the suffixes as) immaterial, so that

$$C_{rst} = C_{srt} = C_{rts} = \quad \dots \quad \dots \quad = (rst) \qquad (r, s, t = 1, 2, 3, \dots \quad )$$

the C's being sometimes omitted altogether as in the last one.

The configuration determined by the 4-line contains 4 lines, 4 circles and 7 points. It was pointed out by Prof. Neville[1] that when the whole figure was inverted with respect to a circle, thus replacing the straight lines by concurrent circles, the resulting figure, both in this case and in the general case of $n$-lines to be discussed later, became symmetric in the sense that any set of concurrent circle could play the same role as the inverses of the straight lines from which the figure was built up. The real content of Prof. Neville's suggestion is, therefore, that the figure should be viewed from the standpoint of Circle Geometry *i.e.* the Geometry of the plane treated with minimal co-ordinates subject to independent linear transformations.[2] When the metrical plane is thus treated as a double-binary space, the essential distinction between the line and the circle disappears, and the lines are merely circles through a definite *point at infinity*. This point has geometrically the same status as any other point and may be transfered anywhere in the plane by an appropriate transformations of the binary co-ordinates. By naming this point C we shall be preserving the essential features (1. 1) and (1. 2) of our notation. It will be this standpoint that will be adopted hereafter, and it will be seen that it makes an inversion of the whole figure unnecessary.

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[1] E. H. Neville: The inverse of the Miquel-Clifford configuration. *Journal of the Indian Mathematical Society* Vol. 16. (1926) Pages 241–7.

[2] The examination of configurations of one Geometry from the standpoint of

With C the figure now becomes an $8_4$ configuration of 8 circles and 8 points of which 4 circles pass through each point and 4 points lie on each circle. The figure may be reconstructed from the circles concurrent at any of the 8 points say (12). The four circles through this point are (2), (1), (123) and (124). We shall now introduce the convention that

> when the same suffix is repeated twice, both may be suppressed; in other words, the addition of a suffix is equivalent to its omission. (1. 3)

It is important to notice that this does not interfere with the property (1. 1), and that (1. 2) will still continue to hold for incident elements so long as the number of their suffixes differs by unity. Thus if $A$ denotes any definite row of figures, the intersections of the circles $(Ar)$ and $(As)$ will be $(Ars)$ and $(A)$, irrespectively of whether $r$ and $s$ occur in $A$ or do not.

We may now rename the four circles through (12) thus:

$$(121) = (2),\ (122) = (1),\ (123),\ (124)$$

The intersections of the first three other than the starting point (12) are:

$$(1212) = (\quad) = C,\ (1223) = (13),\ (1213) = (23),$$

and the circle through these is (12123) which is the same as (3). Similarly the circum-circles of the other three triangles are 12 (234, 341, 412)[1] and these are all concurrent at (121234) or (34). The above argument shows that any of the 8 points could be taken as the starting point and the configuration built up from the four circles concurrent thereat in the same manner as it was originally built up from the four lines through C; and that the Miquel point[2] of any of the eight points is the one obtained by adding 1234 to its suffixes, that is, by replacing its suffixes by their complimentary set. Thus the Miquel points of C, $C_{12}$, $C_{1234}$ with respect to the four circles concurrent at them are respectively $C_{1234}$, $C_{34}$, and C.

**2.** With a fifth line $C_5$, or from our point of view, a fifth circle through C, we have five Miquel points (1234), (2345), (3451), (4512), and (5123) by taking the lines in sets of four. Miquel proved in 1896 that these five points lie on a circle which we name appropriately (12345). This is the Clifford Circle of C with respect to (1), (2), (3), (4), (5). With

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another with a different transformation group is a fascinating study opened up by the ideas developed in Klein's *Erlanger Programme*. Compared to the richness of the field, the amount of work done is astonishingly small. An idea of the new symmetries which arise from such a change of outlook may be gathered from the elaborate "Memoir on Cubic Transformations associated with a Desmic System" by Dr. R. Vaidyanathaswami (Supplement, *Jour. Ind. Math. Soc.* vol. 17) where the isogonal transformation associated with a metrical triangle is studied from the standpoint of the tetracyclic plane.

[1] This means that the figures 12 are to be taken with each of the sets occurring within the brackets thus: (12234), (12341), (12412).

[2] From the standpoint of Circle Geometry, if $C_1$ $C_2$ $C_3$ $C_4$ are 4 Circles though

6 lines we shall have 5 such Clifford Circles which are, as Clifford showed in 1870, concurrent. Clifford proved[1] also that this alternation of concurrent circles and concyclic points persists indefinitely.

In his paper referred to earlier, Prof. Neville has pointed out that when the theorem of concurrence for 4 circles has been proved, the incidence theorems which are required as more circles are introduced through C will be obvious if we reconstruct the figure from any of the other points. Thus to prove that the five points (1234), (2345), (3451), (4512), (5123) are concyclic we start with say (12) and the three circles (123), (124), (125) through it. These form a triangle whose vertices are (1234), (1245), and (1253), and the circle through these — the Clifford circle of (12) with respect to the three circles through it — we name provisionally (12345). This circle also passes through (2345) = (123451) and through (3451) = (123452) since these are the Miquel points of (12) with respect to the circles 12 (3, 4, 5, 1) and 12 (3, 4, 5, 2) respectively.

Lastly, assume that the necessary incident relations have been proved for a figure generated from $n-1$ concurrent circles ($n>5$) and that an additional circle $C_n$ through C has been added. It has to be shown that the elements

$$(234\ldots n),\ (134..n),\ (124.\ n),\ldots\ \ldots(123..n-1) \qquad (2.\ 1)$$

are a set of concurrent circles ($n$ even) or concyclic points ($n$ odd). But if we start with (12) and the $n-2$ circles 12 (3, 4, ..$n$) through it and reconstruct the figure, we shall successively encounter the intersection points 12 (34, 35, 45, ..) the circles through these three at a time 12 (345, 346, 456, ..). and finally the concurrent or concyclic set

$$12\,(456\ldots n,\quad 356\ldots n,\quad 346\ldots n,\ \ldots\ 345\ldots n-1),$$

since the necessary incidence relations hold for figures generated from $(n-2)$ concurrent circles. But this set is included in the set (2. 1) and consists, in fact, of all its members which contain the figures 1 and 2. Similarly all the members of (2. 1) which have the figures 23 in common are concurrent or concyclic, so that since $n>5$ the set as a whole denotes a system of concurrent circles if $n$ is even, and concyclic points if $n$ is odd. In either case we denote the element which has incidence with the set by (123..$n$).[2]

We thus have

*for any value of* n *there is a homogeneous system of* $2n-1$ *circles and* $2n-2$ *points such that* n *circles pass through each of the points and* n *of the points lie on each of the circles.*

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C, there exists a direct circular transformation of period 2 (an involution) which interchanges (12) and (34), (14) and (23), (13) and (24). The Miquel point of any of the 8 points is the mate of that point in the involution. *c.f.* Ramamurti: A construction for the double points of an involution; *Jour. Ind. Math. Soc.* Vol. XVIII Pt. II pp. 257-559. It would be interesting to know if there is any such interpretation for the Miquel Point of configurations generated by more than 4 concurrent circles.

[1] *Collected Mathematical papers*: "Synthetic proof of Miquel's Theorem." Pages 51-54.

[2] Clifford's own proof is based on the properties of the $n$-fold parabola and applies only to the figure generated from $n$ straight lines.

For a neat proof of the incidence theorems by methods of analytical geometry vide: V. Ramaswami Aiyar and M. Bhimasena Rao: Miquel Points and Circles and Centre Circles of a system of lines, *Journal Ind. Math. Soc.* Vol. 16 pp. 270-278.

We have still to show that in the general case the configuration is homogeneous in the sense that C plays no special role, and that the configuration could be reconstructed from the $n$ circles concurrent at any of its points. This follows readily from the incidence relations which characterise the notation. Thus consider the point $C_A$ where A is an ensemble of an even number of suffixes. The circles through the point are (A1), (A2),....(A$n$); the intersections of these other than (A) are (A12), (A23), (A31), (A14),...etc. ; the circles through these taken in threes are (A123), (A124), (A234),...etc. It will thus be seen that as more and more circles (A1), (A2) etc., through A are taken and the corresponding configurations formed, the development mimics the process by which the configuration was originally developed from the circles (1), (2), (3), through C. The last element reached will be (A123 · · $n$) which has suffixes complementary to A, and will be the Miquel Point of A if $n$ is even, and its Clifford Circle if $n$ is odd.

**3.** By the *group of a figure* we mean the group of permutations of the elements of the figure which preserves all the incidence relations therein. In our figure there are two kinds of elements, circles and points, and according as the automorphism is restricted to carry elements of each kind into themselves or not, we shall have a group in the narrower or wider sense of the word.[1] Let us consider the former.

Since the figure can be reconstructed from the circles concurrent at any of the points, the group is transitive. Let $T_1$, $T_2$, $T_3$, . . $T_n$ be $n$ operators of which the first operating on the symbol of a point or a circle adds 1 to the suffixes already existing, the second adds 2, and so on. Since by (1. 3) a twice repeated suffix may be suppressed, these operators are all of period two *i.e.*

$$T_1^2 = T_2^2 = T_3^2 = \quad \dots \quad \dots \quad = T_n^2 = 1. \qquad (3.1)$$

Also since the order of the suffixes is indifferent

$$T_r\, T_s = T_s\, T_r = T_{rs} \quad \text{(say)}$$

so that the group is Abelian. The group G thus generated is of order $2^{n+1}$ and the product of an even number of generating operators $T_r$ constitute a subgroup H of order $2^n$. The operators of H carry any point or circle of the configuration into any of its other points or circles. Thus we pass from $(rst\dots)$ to $(r's't'\dots)$ where both are elements of the same kind (*i.e.* both odd or both even) by means of the transformation

$$T_{rst\dots\dots\dots r's't'}$$

which belongs to H. Now the most general automorphism which carries points into points and circles into circles must carry C the *point at infinity* into some point say $C_A$, where A contains an even number of suffixes and it must carry the $n$ circles (1), (2),...($n$), through C into the circles (A1), (A2),...(A$n$) in some order. And when both these have been fixed, the successive elements which arise when the figure is developed from C. and the circles through it, correspond to the elements arising likewise when the figure is developed from $C_A$ and the associa-

[1] "Konfigurationsgruppe im engeren Sinne" and "Konfigurationsgruppe im weiteren Sinne." vide Levi : *Geometrische Konfigurationen*: S 27.

ted circles through it. Hence the most general automorphism of the figure which conserves the character of the elements is obtained when to the suffixes of each element are added any the same set A of an even number of figures, and the figures $1, 2, \ldots n$ are then subjected to an arbitrary permutation, the same for all the elements. Thus

> *The automorphic group of the configuration in the narrower sense is the product of the Abelian Group H of order $2^n$ and the general permutation group on n symbols.*

On the other hand, if all the operators of the above group are multiplied by $T_r$, we shall have an automorphism which interchanges points and circles, and it is easy to see that every such automorphism is the product of say $T_1$ and a definite automorphism of the narrower group. Hence

> *The automorphic group of the configuration in the wider sense is the product of the Abelian group G of order $2^{n+1}$ generated by n permutable operations each of period two, and the general permutation group on n symbols.*

# Rotation of Hα Dark Markings near the Equator

## Compared with other Disc Phenomena *

BY

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In Kodaikanal Observatory Bulletin No. 89, Dr. Royds has investigated the rotation of Hα dark markings, from the spectroheliograms of the years 1926–29, by measurements near the central meridian for successive rotations of the same marking. Owing to the paucity of markings of long duration near the equator during that period much weight cannot be attached to the values obtained for latitudes less than 15°.

To obtain reliable data for the rotation of markings near the equator, the Hα spectroheliograms for the 8 years 1918–1925 have been now examined. The life of each marking was traced in the solar charts of the Kodaikanal Observatory for at least a revolution and a half. 117 such recurrent markings were then examined in the original photographs when they were near the central meridian. Measures were made of the longitudes of the western edges of the markings at 5° intervals of latitude. The times of actually crossing the central meridian were deduced for intervals of 5° of latitude assuming the approximate value of 13° per day for synodic rotation to reduce the positions near the central meridian to the actual time of crossing it. The synodic period of each marking at the several points were thus obtained and the daily sidereal angular motion deduced by taking account of the sun's motion.

The mean values for the whole period at 5° intervals of latitude near the equator of the synodic period, daily synodic angular motion and daily sidereal angular motion are given in Table A. The motion is assumed to be symmetrical with respect to the solar equator.

### Table A.

*Mean Rotation of Hα Absorption Markings.*

| Latitude | 0 | 5 | 10 | 15 | 20* | 25* | 30* | 35* | 40* | Means of all 15·1 |
|---|---|---|---|---|---|---|---|---|---|---|
| No. of Markings | 35 | 73 | 83 | 93 | 47 | 40 | 30 | 23 | 6 | |
| Synodic Period | 26·83 | 26·85 | 26·95 | 27·05 | 27·22 | 27·38 | 27·54 | 27·81 | 27·86 | 27·11 |
| Daily angular velocity synodic | 13·42 | 13·41 | 13·36 | 13·33 | 13·22 | 13·14 | 13·07 | 12·94 | 12·91 | 13·29 |
| Daily angular velocity sidereal | 14·40 | 14·40 | 14·34 | 14·30 | 14·21 | 14·13 | 14·06 | 13·93 | 13·90 | 14·27 |

In table B. has been collected, for purposes of comparison, the speeds of rotation of the sun at different latitudes as obtained from various disc

*(*Summarised from Kodaikanal Observatory Bulletin No. 93 by kind permission of the Director.*)

(From Table I Bulletin No. 89.)

phenomena. The values are taken from the latest available sources. The speeds for the 5° zones have been computed as the mean of the speeds at the boundaries of the zone.

## Table B

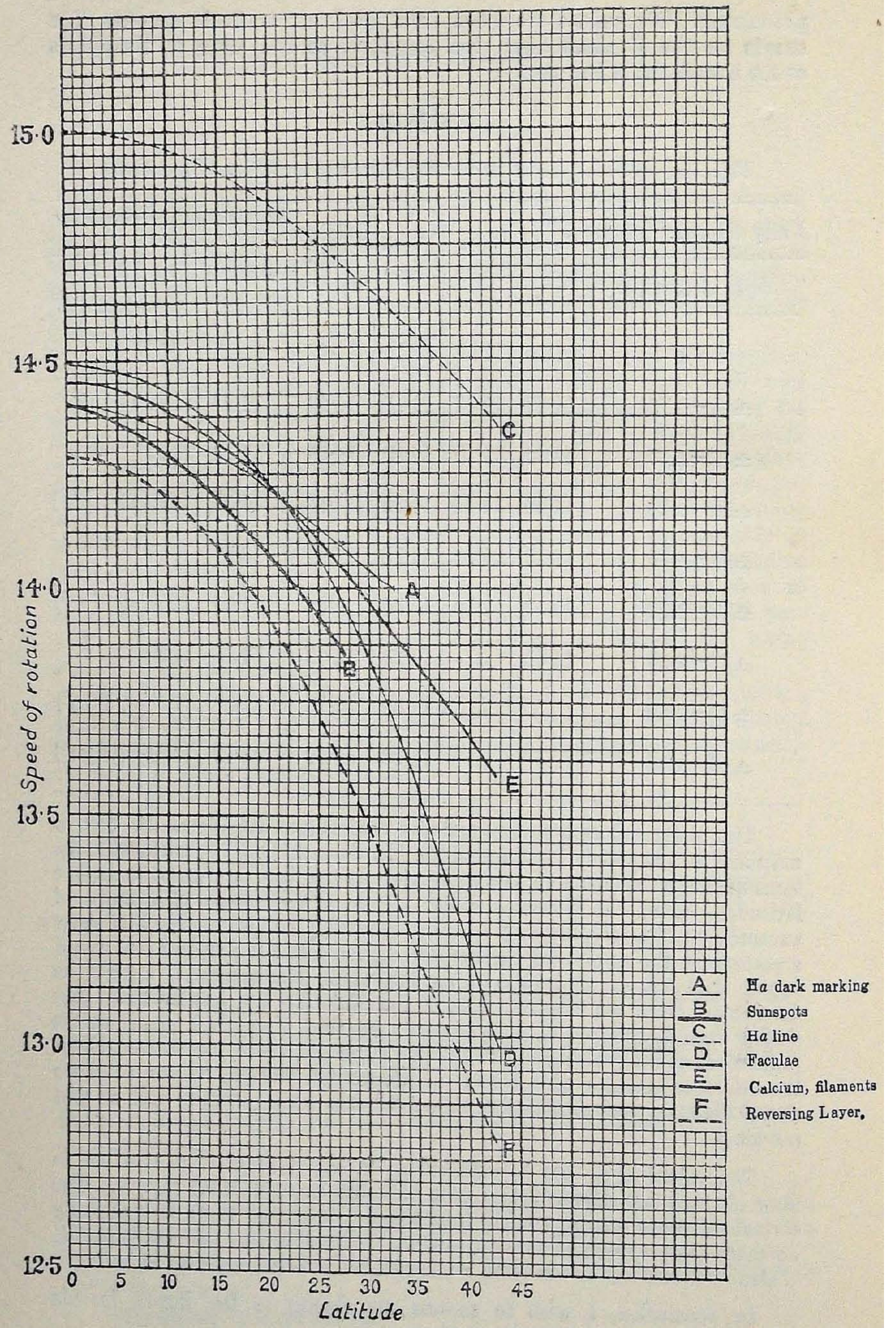
*Velocities of Solar Rotation derived from Various Solar Phenomena*

| Daily sidereal Motion. / Zone of latitude | Hα dark marking | Sun-spots | Faculae | Calcium Filaments | Spectroscopic determinations: Reversing layer | Hα line | K Prominences |
|---|---|---|---|---|---|---|---|
| 0 − ± 5 | 14·40 | 14·39 | 14·49 | 14·45 | 14·27 | 15·00 | |
| ± 5 − ±10 | 14·37 | 14·33 | 14·46 | 14·42 | 14·26 | 14·98 | 17·1 (9) |
| ±10 − ±15 | 14·32 | 14·25 | 14·40 | 14·36 | 14·16 | 14·94 | |
| ±15 − ±20 | 14·26 | 14·13 | 14·30 | 14·28 | 14·02 | 14·88 | 17·1 (18°) |
| ±20 − ±25 | 14·17 | 14·01 | 14·16 | 14·17 | 13·83 | 14·80 | |
| ±25 − ±30 | 14·10 | 13·85 | 13·96 | 14·04 | 13·60 | 14·70 | 20·2 (25°) |
| ±30 − ±35 | 14·00 | ... | 13·71 | 13·89 | 13·35 | 14·60 | |
| ±35 − ±40 | ... | ... | 13·39 | 13·75 | 13·07 | 14·48 | 16·6 (35°) |
| ±40 − ±45 | ... | ... | 13·02 | 13·59 | 12·79 | 14·36 | 17·3 (51°) |

The above values are represented graphically in the figure. It will be noticed that the speed of rotation of the Hα dark markings is practically the same as that of sunspots in the equatorial regions but is greater in higher latitudes. From the closeness of the values of the speeds of rotation of sunspots and Hα dark markings near the equator it is to be inferred that these markings in the equatorial regions are anchored to the sunspots. It would appear that this is not true in higher latitudes. The equatorial velocity as determined from the displacements of the Hα line are greater than that of the dark markings. If, as is generally assumed, these dark markings are projections of the prominences on the Sun's disc and as Evershed has shown the velocities increase with levels, an absorption marking seems to move slower than the gases constituting the prominence which exhibits itself as that marking.

The values of $h_1$ and $h_2$ obtained by Dr. Royds require modification in view of the more reliable values now available for equatorial regions. The revised values do not differ much from the old values and there is practically no change in the mean values of $h_1$ and $h_2$. The difference between $h_1$ and $h_2$ is also unaltered and so the main arguments of the paper continue to hold.

In conclusion, I wish to express my thanks to Dr. Royds, for his valuable guidance and many suggestions.




**Comparison of Speeds of Rotation.**

# A Statistical Analysis of the Medical Examination of Students of the Sri Minakshi College

(*The Nucleus of the Annamalai University*) *for the years* 1927–1928 *and* 1928–1929

By

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The medical examination of the College students of the Madras University was started in the year 1927–1928 and is limited every year to junior students only. It is conducted by a medical officer possessing an M.B. B.S., or L.M.S., degree or one with an equivalent qualification. The particulars to be noted and the physical measurements to be made by the medical examiner are given in a form which is practically the same for all the colleges of the Madras University and is the one now in use in the Annamalai University.[1] It is therefore possible, if detailed analysis of these inspections are available, to compare the results and obtain data sufficiently large for fixing fairly accurately the general average physical measurements of the South Indian student at different ages.

In their first report published in July, 1921, the Student Welfare Committee of Calcutta say, " We do not at present know what is the standard of a student's weight at a certain age in India. Should we be guided by the weight of a student in the foreign country ? Is the Indian boy to be as heavy and as developed as a foreigner at a certain age ? " And again in their report for the year 1923. " Students very often approach us with a request to examine them and let them know whether they are underweight or overweight, whether their height is normal or not and so on. Unfortunately hitherto we had no data to enable us to pass any reliable verdict on normality. When the Student Welfare Committee began its work, it was one of our aims to establish the norms for the different items in the case of Bengali students. Now that we have had a record of over 7,000 cases, we think we are justified in fixing down the limits of normality. The fact that the averages for the different items have now become practically constant, would indicate that normal limits could be determined with a sufficient degree of reliability to meet all practical requirements." [2]

I am afraid that in the year 1932, we are perhaps in precisely the same position here in South India as the Student Welfare Committee found itself in 1921.[3] A brief analysis of the medical inspection of the students of the Sri Minakshi College for the first two years is attempted

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[1] A copy of the form in use at the time of this report in the colleges of the Madras University may be found in pages 66, 67 of the report of the Inter-University Board, India, for the year 1930–31.

[2] *Calcutta Review*—Vol XIII, Appendix page 8.

[3] This seems to be the first attempt at an analysis of the results of medical inspection of the college students of the Madras University.

here. The college grew into a University in 1929 and as an independent body evolved its own rules regarding physical training. As the training of the physique may have some influence on the physical measurements the figures for the year 1930-31 and succeeding years will have to be analysed separately. The figures for 1929-30 may act as a connecting link between the period under examination and the period from 1930-31, so far as the Annamalai University is concerned. The publication of the data available so far from the colleges of the Madras University or even the accumulation of the data of medical inspection of the University for a number of years will be helpful for the purpose.

Three hundred and twelve students were examined in the year 1927-28 and 311 in the next year, all of whom were males. An attempt has been made to compile separately the statistics for science students and for arts students ; the students with Mathematics, Physics, Chemistry as optional subjects are classed as science students. They are distributed in the several classes as follows :—

Table I

| CLASS | 1927-28 | 1928-29 |
|---|---|---|
| ARTS | | |
| Inter I ... ... | 85 | 82 |
| B.A. I ... ... | 61 | 74 |
| Hons. I ... ... | 16 | 13 |
| Total ... | 162 | 169 |
| SCIENCE | | |
| Inter I ... ... | 94 | 89 |
| B.A. I ... ... | 56 | 53 |
| Total ... | 150 | 142 |
| GENERAL TOTAL | 312 | 311 |

The medical examination is at present confined to measurements of bodily dimensions and to the detection of visual, developmental and other bodily defects. There is no provision for tests of functional capacities. Quantitative data are available only for (i) age, (ii) height, and (iii) weight. The original data of these measures have been sorted and are set out in frequency groups so as to give the number at each year of age, inch of height and interval of five pounds of weight.[1]

## AGE

The age entered in Table II is that attained on January 1st in the academic year in which the medical examination was conducted, by assuming that on the average all the births recorded in any calendar year may be centred at July 1st of that year.[2]

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[1] As the frequency distributions had to be arranged only in so far as individual records were available there are some discrepancies in the totals of the several traits.

[2] I have generally chosen the class intervals adopted by Mr. K. B. Madhava, so that comparison of these figures with those for Mysore may be possible.

## Table II

| AGE | | | 1927–28 | 1928–29 |
|---|---|---|---|---|
| 14·5 | ... | ... | 2 | ... |
| 15·5 | ... | ... | 9 | 7 |
| 16·5 | ... | ... | 31 | 36 |
| 17·5 | ... | ... | 55 | 54 |
| 18·5 | ... | ... | 64 | 63 |
| 19·5 | ... | ... | 50 | 61 |
| 20·5 | ... | ... | 43 | 40 |
| 21·5 | ... | ... | 22 | 19 |
| 22·5 | ... | ... | 15 | 15 |
| 23·5 | ... | ... | 15 | 8 |
| 24·5 | ... | ... | 4 | 5 |
| 25·5 | ... | ... | 1 | 2 |
| 26·5 | ... | ... | 1 | ... |
| * * * | ... | ... | * * | * * |
| 32·5 | ... | ... | ... | 1 |
| | | Total | 312 | 311 |

The values of the mean, standard-deviation, co-efficient of variation, $\beta_1$, $\beta_2$, $k$ of the distribution are given in Table II-A for the two years. These values although numerically different are statistically speaking the same, the differences being most probably due to fluctuations of sampling. The frequency diagrams appear to be of the Pearsonian type with moderate skewness and with values of the criterion slightly different from zero. But it is interesting to note that the values of the three constants $\beta_1$, $\beta_2$, $k$, for the year 1928–29 do not warrant this conclusion. An examination of the original distribution shows that in that year there is an abnormal case of a student with age 32·5 which is responsible for this difference. If this abnormal case be left out of account (as it is really exceptional) the values of $\beta_1$, $\beta_2$, $k$ in 1928–29 come very near to their values for the previous year. This lends colour to the remark of Mr. K. B. Madhava that even in regard to the age in the make-up of an educational institution of a certain status there is some permanence in distribution.[1]

## Table II-A

| | 1927–28 | 1928–29 |
|---|---|---|
| Size of the universe | 312 | 311 |
| Mean age ... ... | 19·218 | 19·172 |
| Standard-deviation ... | 2·274 | 2·122 |
| Co-efficient of variation ... | 11·832 | 11·069 |
| $\beta_1$ ... ... | 0·111 | 1·689 |
| $\beta_2$ ... ... | 2·366 | 7·444 |
| $k$ ... ... | 0·074 | 0·487 |

[1] K. B. Madhava : Report on the Statistical Analysis of the Medical Examination of students of the Mysore University, Mysore, 1928, page 5.

The mean ages are recorded below according to (i) class in which the student is studying, (ii) his community mainly divided as Brahmin and non-Brahmin, (iii) his bodily, (iv) his visual and (v) his nutritional condition as declared by the medical examiner.

### Table II-B

| | | 1927–28 | | | 1928–29 | |
|---|---|---|---|---|---|---|
| | | ARTS | SCIENCE | | ARTS | SCIENCE |
| Intermediate I | ... | 18·36 | 18·13 | ... | 18·48 | 17·73 |
| B.A. I | ... | 21·35 | 19·89 | ... | 20·89 | 20·18 |
| Hons. I | ... | 19·88 | — | ... | 19·42 | — |
| Sectional | ... | 19·62 | 18·78 | ... | 19·62 | 18·64 |
| Body good | ... | 19·87 | 18·92 | ... | 19·72 | 18·83 |
| Body defective | ... | 18·75 | 18·29 | ... | 18·85 | 17 97 |
| Vision good | ... | 19·63 | 18·11 | ... | 19·42 | 18·54 |
| Vision defective | ... | 19·60 | 18·60 | ... | 19·94 | 18 75 |
| Brahmin | ... | 19·36 | 18·39 | ... | 19·25 | 18·40 |
| Non-Brahmin | ... | 20·19 | 20·22 | ... | 20·37 | 19·65 |
| Poor nutrition | ... | 18·50[1] | 17·00 | ... | 18.43 | 17·12 |
| Fair nutrition | ... | 19·36 | 18·43 | ... | 19·53 | 18·80 |
| Good nutrition | ... | 20·17 | 19·56 | ... | 20·06 | 19·37 |
| Very good nutrition | ... | ... | 20·50 | ... | ... | ... |
| General | ... | 19·22 | ... | | 19·17 | ... |

On comparing the differences of these means with their probable errors, we notice that (i) the mean ages according to classes studied in differ to about the same extent as their pedagogical standards indicate; (ii) the mean ages of Honours students are consistently lower than B.A. students though pedagogically they are of the same standard; (iii) the mean ages of students with bodily defects are constantly lower than those of others, these being perhaps the effect and the cause.

## HEIGHT

The frequency distribution by height is given in Table III below. The height entered in each row is the middle of the interval of one inch in which it is included, by assuming that on the average all the records in any interval may be centred thereat.

### Table III

| HEIGHT | | | 1927–28 | 1928–29 |
|---|---|---|---|---|
| 54·5 | ... | ... | ... | 1 |
| 55·5 | ... | ... | 3 | ... |
| 56·5 | ... | ... | 2 | 1 |
| 57·5 | ... | ... | 2 | 2 |
| 58·5 | ... | ... | 5 | 4 |
| 59·5 | ... | ... | 3 | 7 |

[1] The averages according to nutritional condition may be noted. There is a progressive increase. This may be due to bias if not accidental.

### Table III—(*contd.*)

| HEIGHT | | | 1927–28 | 1928–29 |
|---|---|---|---|---|
| 60·5 | ... | ... | 11 | 15 |
| 61·5 | ... | ... | 26 | 25 |
| 62·5 | ... | ... | 43 | 31 |
| 63·5 | ... | ... | 34 | 51 |
| 64·5 | ... | ... | 41 | 51 |
| 65·5 | ... | ... | 59 | 51 |
| 66·5 | ... | ... | 49 | 30 |
| 67·5 | ... | ... | 20 | 25 |
| 68·5 | ... | ... | 7 | 7 |
| 69·5 | ... | ... | 3 | 6 |
| 70·5 | ... | ... | 2 | 2 |
| 71·5 | ... | ... | ... | 1 |
| 72·5 | ... | ... | ... | ... |
| 73·5 | ... | ... | 1 | ... |
| | Total | ... | 311 | 310 |

Table III-A gives the central tendencies and measures of scatter, variability, criterion, etc., for each year of investigation. The mean is steady but the standard-deviation and therefore the co-efficient of variability show large deviations (about four times the probable error) which might not very improbably be due to fluctuations in sampling. It is unsafe to make any deduction until records are accumulated for years and compared.

### Table III-A

| | | | 1927–28 | 1928–29 |
|---|---|---|---|---|
| Size of universe | ... | ... | 311 | 310 |
| Mean height | ... | ... | 64·298 | 64·265 |
| Standard-deviation | | ... | 2·584 | 2·305 |
| Co-efficient of variation | | ... | 4·019 | 3·587 |
| $\beta_1$ | ... | ... | 0·288 | 0·163 |
| $\beta_2$ | ... | ... | 4·188 | 5·147 |
| $k$ | ... | ... | 0·155 | 0·035 |

The frequency diagrams are of the Pearsonian type with slight skewness and with values of the criterion slightly different from zero. The values of the three constants given in the table give a type very similar to the distribution of age groups; this is rather surprising. Height is supposed to be a physiological function peculiarly affected by the Law of Normal Probability and other investigations on height variations have invariably resulted in giving distributions very markedly symmetrical. The data considered, however, are rather inadequate to assert anything; analysis of the data for subsequent years thus increasing the quantity of material under examination is necessary.

The mean heights of the students according to their classes, community and other pathological conditions are set out in full in Table III-B below.

**Table III-B**

| | 1927–28 ARTS | 1927–28 SCIENCE | 1928–29 ARTS | 1928–29 SCIENCE |
|---|---|---|---|---|
| Intermediate I ... ... | 64·02 | 63·59 | 64·24 | 63·09 |
| B.A. I ... ... | 65·21 | 64·77 | 65·19 | 64·65 |
| Honours I ... ... | 64·81 | ... | 65·50 | ... |
| Sectional ... ... | 64·54 | 64·03 | 64·75 | 63·68 |
| Body good ... ... | 64·81 | 64·15 | 64·86 | 64·02 |
| Body defective ... ... | 63·61 | 63·62 | 64·00 | 62·50 |
| Vision good ... ... | 64·75 | 64·09 | 65·09 | 63·67 |
| Vision defective ... | 64·17 | 63·94 | 64·20 | 63·69 |
| Brahmin ... ... | 64·36 | 63·79 | 64·38 | 63·36 |
| Non-Brahmin ... ... | 64·95 | 64·91 | 65·54 | 65·04 |
| Poor nutrition ... ... | 62·64 | 63·36 | 62·86 | 61·09 |
| Fair nutrition ... ... | 63·89 | 63·27 | 64·73 | 64·05 |
| Good nutrition ... ... | 65·66 | 65·30 | 65·25 | 64·57 |
| Very good nutrition ... | ... | 64·50 | ... | ... |
| General ... ... | 64·30 | | 64·26 | |

WEIGHT

The following table gives the frequency distribution by weight during the period. The weight entered is the middle of the interval of five pounds in which it is included by assuming that on the average all the records in any interval may be centred there.

**Table IV**

| WEIGHT | 1927–28 | 1928–29 |
|---|---|---|
| 60 ... ... | ... | 1 |
| 65 ... ... | 1 | 1 |
| 70 ... ... | 3 | 4 |
| 75 ... ... | 4 | 2 |
| 80 ... ... | 15 | 7 |
| 85 ... ... | 8 | 17 |
| 90 ... ... | 22 | 10 |
| 95 ... ... | 37 | 29 |
| 100 ... ... | 42 | 50 |
| 105 ... ... | 39 | 27 |
| 110 ... ... | 47 | 58 |
| 115 ... ... | 28 | 31 |
| 120 ... ... | 23 | 19 |
| 125 ... ... | 16 | 22 |
| 130 ... ... | 6 | 12 |
| 135 ... ... | 4 | 4 |
| 140 ... ... | 6 | 5 |
| 145 ... ... | 4 | 1 |
| 150 ... ... | 2 | 1 |
| 155 ... ... | 1 | 4 |
| 160 ... ... | ... | 3 |

Table IV—(*contd.*)

| WEIGHT | | | 1927–28 | 1928–29 |
|---|---|---|---|---|
| 165 | ... | ... | 1 | ... |
| 170 | ... | ... | ... | 1 |
| 175 | ... | ... | ... | ... |
| 180 | ... | ... | ... | ... |
| 185 | ... | ... | 2 | ... |
| | Total | ... | 311 | 309 |

These frequency diagrams are very uneven and are as usual skew. The values of the mean, standard-deviation, co-efficient of variation $\beta_1$, $\beta_2$, $k$ are given below in Table IV-A.

Table IV-A

| | | 1927–28 | 1928–29 |
|---|---|---|---|
| Size of universe | ... | 311 | 309 |
| Mean weight | ... | 106·51 | 108·06 |
| Standard-deviation | ... | 16·954 | 16·697 |
| Co-efficient of variation | | 15·918 | 15·451 |
| $\beta_1$... ... | ... | 0·826 | 0·249 |
| $\beta_2$... ... | ... | 5·701 | 4·291 |
| $k$ ... ... | ... | 0·263 | 0·110 |

The mean weights of the students for the several sub-classes (as mentioned in relation to age) are as usual appended. This table may call for a few comments. (*a*) The medical examiner is requested to classify the individuals according to his estimate of nutritional development and they have been classified as poor, fair, good and very good (in some exceptional cases). Though such a subjective classification is

| | | 1927–28 | | 1928–29 | |
|---|---|---|---|---|---|
| | | ARTS | SCIENCE | ARTS | SCIENCE |
| Intermediate I ... | ... | 104·47 | 100·70 | 106·73 | 100·34 |
| B.A. I ... | ... | 114·02 | 111·70 | 115·55 | 111·98 |
| Honours ... | ... | 104·37 | ... | 110·77 | ... |
| Sectional ... | ... | 108·06 | 104·83 | 110·86 | 104·73 |
| Body good ... | ... | 110·72 | 106·09 | 111·71 | 108·17 |
| Body defective ... | ... | 98·75 | 100·59 | 104·21 | 92·97 |
| Vision good ... | ... | 108·17 | 104·67 | 111·88 | 104·04 |
| Vision defective ... | ... | 107·85 | 105·08 | 109·22 | 105·56 |
| Brahmin ... | ... | 106·85 | 103·21 | 110·31 | 104·26 |
| Non-Brahmin ... | ... | 110·69 | 110·78 | 112·04 | 106·73 |
| Poor nutrition ... | ... | 95·00 | 87·14 | 90·00 | 82·76 |
| Fair nutrition ... | ... | 99·63 | 95·89 | 106·03 | 102·09 |
| Good nutrition ... | ... | 122·38 | 120·45 | 124·21 | 122·77 |
| Very good nutrition | ... | ... | 155·00 | — | — |
| General ... | ... | 106·51 | | 108·06 | |

open to some amount of personal bias the table shows that clearly distinguishable regions are embraced by these divisions and that these represent continuously increasing degrees of development.[1] (*b*) The mean values of the groups included in the classifications "Body good" and "Body defective" are widely separated; this shows that the pathological or nutritional development clearly impresses its significance on the recorded weight of an individual. (*c*) The condition of the eye does not appear to have any marked influence on the weight. (*d*) The mean weights of students divided according to classes show similar differences, a part of which at least must naturally be due to the time interval that ordinarily separates the stages. It is significant, however, that the science student is in general lighter than the arts student of similar status and that the honours student is also in general lighter than the pass student of similar status.

The medical officer is also expected to record the developmental and other defects, if any, in the body of the subject under different heads, skin, teeth, nose, throat, eye, ear, etc. It is obvious that at a single and casual examination several defects would have escaped detection and diagnosis. The time available for finding out such defects is limited and the process of diagnosis was confined merely to the observational method and even such of the defects as have been localised work up to a high case rate. An analysis of these defects will be attempted in the next issue.

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[1] Some allowance will, of course, have to be made for the difference in mean ages noted in Table II-B. The difference is still noticeable.

# On the Indeterminate Equation $x^y - y^x = a$

BY

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*Theorem I* :—*If* $N(a)$ *is the number of solutions of*

$$0 < x^y - y^x \leqslant a,$$

*where* $x$ *and* $y$ *are positive integers* $> 1$, *then*

$$N(a) \sim \tfrac{1}{2} \frac{(\log a)^2}{(\log \log a)^2}$$

Let $r$ be a given positive integer, $m > r$, and

$$r^m - m^r \leqslant a. \tag{1}$$

Now

$$\log r^{r+1} = (r+1) \log r,$$

and $\log (r+1)^r = r \log (r+1) = r \log r + 1 - \frac{k}{r}$,

where $0 < k < 1$.

$$\therefore \qquad \log \frac{r^{r+1}}{(r+1)^r} = \log r - 1 + \frac{k}{r}.$$

Therefore, when $r \geq 6$, $\qquad \frac{(r+1)^r}{r^{r+1}}, < \tfrac{1}{2}.$

Hence, when $m > r \geq 6$, if $r^m - m^r \leqslant a$,

that is, if,

$$r^m \left(1 - \frac{m^r}{r^m}\right) \leqslant a,$$

then $\qquad \frac{r^m}{2} \leqslant a$, because $\frac{m^r}{r^m}$ decreases when $m$ increases beyond $r$.

Consequently,

$$m \leqslant \frac{\log a}{\log r} + \frac{\log 2}{\log r}. \tag{2}$$

Also, from (1)

$$m_{max} \geq \frac{\log a}{\log r}. \tag{3}$$

Hence

$$m_{max} = \frac{\log a}{\log r} + O(1) \qquad \text{from (2) and (3).}$$

So when $r$ is a given integer not less than 6, the number of solutions of $r^m - m^r \leqslant a$ is

$$\frac{\log a}{\log r} - r + O(1). \tag{4}$$

But the maximum value of $r$ is given by $[x]$ where $x$ satisfies

$$x^{x+1} - (x+1)^x = a.$$

Since $r > 6$,

$$a < x^{x+1} < 2a.$$

$$\therefore \quad x = \frac{\log a}{\log x} + O(1) \tag{5}$$

$$\therefore \quad \log x = \log \log a - \log \log x + O(1)$$

$$\therefore \quad x = \frac{\log a}{\log_2 a} + \frac{\log a \times \log_3 a}{(\log_2 a)^2} + O\left\{\frac{\log a}{(\log_2 a)^2}\right\}$$

$$\therefore r_{max} = \frac{\log a}{\log_2 a} + \frac{\log a \times \log_3 a}{(\log_2 a)^2} + O\left(\frac{\log a}{(\log_2 a)^2}\right)$$

$\therefore$ If $T_r$ is the number of solutions of

$$0 < r^m - m^r \leqslant a,$$

then

$$N(a) = \sum_{r=2}^{t} T_r + O(1), \qquad \text{where } t = r_{max}$$

$$= \sum_{r=2}^{5} T_r + \sum_{r=6}^{t} T_r + O(1)$$

$$= S_1 + S_2 + O(1) \text{ say.}$$

Now

$$S_1 = O\left(\sum_{r=2}^{5} \frac{\log a}{\log^2 r}\right) = O(\log a)$$

$$S_2 = \sum_{r=6}^{t} \left\{\frac{\log a}{\log r} - r + O(1)\right\}$$

$$= \log a \left\{\int_6^t \frac{dr}{\log r} + O(1)\right\} - \sum_{r=6}^{t} r + O(t)$$

$$= \log a \times \frac{t}{\log t} + O\left(\frac{t \log a}{(\log t)^2}\right) - \frac{t^2}{2} + O(t) + O(\log a)$$

$$= \left(\frac{\log a}{\log_2 a}\right)^2 + \frac{(\log a)^2 \log_3 a}{(\log_2 a)^3} + O\left(\frac{(\log a)^2}{(\log_2 a)^3}\right)$$

$$- \tfrac{1}{2}\left(\frac{\log a}{\log_2 a}\right)^2 - \frac{(\log a)^2 \log_3 a}{(\log_2 a)^3} + O\left(\frac{(\log a)^2}{(\log_2 a)^3}\right) + O(\log a)$$

$$= \tfrac{1}{2} \frac{(\log a)^2}{(\log \log a)^2} + O\left(\frac{(\log a)^2}{(\log \log a)^3}\right).$$

*Theorem II:—If* N′ (*a*) *is the number of solutions of*

$$x^y - y^x = a,$$

*then when a exceeds a certain limit,*

$$N'(a) \leqslant (1+\delta) \frac{\log a}{\log \log a}.$$

When $r > 6$,

$$r^{r+1} - (r+1)^r < r^{r+t} - (r+t)^r.$$

Hence the maximum value that $x$ can assume is given by

$$x^{x+1} - (x+1)^x = a.$$

Therefore, from 5,

$$x \leqslant (1+\delta) \frac{\log a}{\log \log a}$$

It is probable that N′ (*a*) is bounded even when $a \to \infty$; it may be even 1. It may be remarked that the number of distinct integers $a$ not exceeding N, which can be represented in the form (6) is greater than $\dfrac{\log N}{\log 2}$

Similar considerations hold also for the inequality $x^y + y^x \leqslant a$.

# Algebraic (2, 1) Correspondence in the Gauss plane[1]

BY

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**1.** Any real point in the Gauss plane can be defined by the minimal coordinates $w$, $\bar{w}$, the parameters of the conjugate minimal lines which pass through that point. Hence an irreducible algebraic (2, 1) correspondence of the complex variables $w$ and $\mu$ given by

$$F = \mu \left( a_{21} w^2 + a_{11} w + a_{01} \right) + \left( a_{20} w^2 + a_{10} w + a_{00} \right) = 0$$

determines a similar correspondence of the minimal lines of one system, But every minimal line $w$ has one and only one real point $(w, \bar{w})$ on it. Hence, the induced correspondence of the real points of the Gauss plane is given by F and its conjugate $\bar{F}$. Throughout this paper let us suppose that $F = 0$ implies $\bar{F} = 0$. The object of this investigation is to study the above correspondence of the real ponits of the Gauss plane, when the locus of one of them is a circle.

Let us denote by D $(w)$ the apolar quadratic covariant of F *i.e.* apolar to F regarded as a quadratic in $w$ for all values of $\mu$ and by $\triangle$ $(\mu)$ the quadratic covariant in $\mu$, the roots of which correspond in F, to D $(w)$. Also, let us refer to the points in the plane corresponding to the roots of D $(w) = 0$ and $\triangle (\mu) = 0$, as the points D $(w)$ and $\triangle$ $(\mu)$ respectively.[2]

**2.** Let us first obtain the locus of P $(w, \bar{w})$ as Q $(\mu, \bar{\mu})$ moves on a circle. The problem can also be formulated in the following manner. F can be considered as a pencil of quadratics, the square members of which correspond to D $(w)$. It is well known that a pencil of quadratics in the complex variable $w$, determines an involution of point-pairs in the Gauss plane, whose double points are the points D $(w)$. Hence the problem is equivalent to finding the locus of point-pairs of an involution, when the complex parameter of the pair traces a circle.

By a suitable linear transformations of $w$ and $\mu$, F can be reduced to the canonical form

$$Z^2 - \lambda = 0,$$

for if $\alpha$, $\beta$ be the roots of D $(w) = 0$,

$$a_{21} w^2 + a_{11} w + a_{01} \equiv A_1 (w - \alpha)^2 + B_1 (w - \beta)^2$$

$$a_{20} w^2 + a_{10} w + a_{00} \equiv A_0 (w - \alpha)^2 + B_0 (w - \beta)^2$$

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[1] I am indebted to Dr. R. Vaidyanathaswamy for suggestion, advice, and criticism in the preparation of this paper.

[2] For these and other covariants of the (2,1) form reference may be made to Saddler: 'The geometric interpretation of the complete system of two Double Binary (2,1) forms, *Proceedings of the Edinburgh Mathematical Society*. Vol. XLIII.

so that $F = (w - \alpha)^2 (A_1 \mu + A_0) + (w - \beta)^2 (B_1 \mu + B_0) = 0.$

$$\text{Let } Z = \frac{w - \alpha}{w - \beta}, \quad \lambda = -\frac{B_1 \mu + B_0}{A_1 \mu + A_0}$$

so that F reduces to $Z^2 - \lambda = 0$. ... (2)

It is obvious that for (2) the points D ($z$) and $\Delta$ ($\lambda$) are identical, being in each case the origin and the point at infinity.

Since $\lambda$ is a linear transform of $\mu$, the locus of $\lambda$ is also a circle, the equation of which can be taken to be

$$l \lambda \bar{\lambda} + a \lambda + \bar{a} \bar{\lambda} + b = 0.$$

where $b$, $l$ are real and $bl - a \bar{a}$ does not vanish.
But $z^2 = \lambda$. Hence the locus of $z$ is

$$l z^2 \bar{z}^2 + a z^2 + \bar{a} \bar{z}^2 + b = 0. \quad .. \quad (3)$$

It is a cyclic, or (2, 2) curve (*i.e.*) every minimal line of either system intersects it in two points. In the Cartesian plane it is a bi-circular quartic given by

$$l (x^2 + y^2)^2 + 2 a_1 (x^2 - y^2) - 2 a_2 xy + b = 0$$

where $a = a_1 + i a_2$.

The cyclic (3) is subrational,[1] *i.e.* it admits of one and hence an infinity of inscribed quadrangles formed by the minimal lines. This can be seen directly as follows:—Take any point ($\lambda$, $\bar{\lambda}$). To the minimal line $\lambda$ correspond the two minimal lines $z_1$, $z_2$ of the same system and similarly to the minimal $\bar{\lambda}$ correspond the two minimal lines $\bar{z}_1$, $\bar{z}_2$ of the other system. Hence to the point ($\lambda$, $\bar{\lambda}$) correspond the four vertices of the quadrangle formed by the above minimal lines, which should hence lie on (3). Similarly for any point on the $\lambda$ circle. Further the pairs of opposite vertices of the quadrangle (of which one is real and the other imaginary) belong to the involution defined by D ($z$).

Since any linear transformation of $z$, and its conjugate carries a subrational cyclic, into a similar cyclic, we have for the general correspondence F of $w$ and $\mu$:—

*If the $\mu$ locus is a circle, the w locus is a subrational cyclic containing the cross pair*[2] *of every pair of the involution defined by D (w).*

---

[1] The necessary and sufficient condition for this is the vanishing of the invariant

$$\begin{vmatrix} a_{22} & a_{12} & a_0 \\ a_{21} & a_{11} & a_{01} \\ a_{20} & a_{10} & a_{00} \end{vmatrix}$$

In this case the double-binary equation to the cyclic can be thrown in the form $f_1(z) = f_2(\bar{z})$ where $f_1$, $f_2$ are rational functions. *Vide* Dr. Vaidyanathaswamy's 'Algebraic (2, 2) correspondence,', *Jour. Ind. Math. Soc.* Vol. XVI.

[2] By the cross pair of A, B is meant the other pair of points of intersection of the minimal lines through A and B.

**3.** Since, when the double points of an involution are given, any pair $w_1, w_2$ of the involution is completely determined by the position of their mid-point $\nu$, we may take $\nu$ to be the parameter of the pair. In fact we have

$$\lambda = \frac{w_1 + w_2}{2} = \frac{a - \beta}{1 - \lambda}\lambda$$

Since $\nu$ is a linear transform of $\lambda$, the locus of $\nu$ is also a circle and conversely. If the $\nu$ locus is a straight line (*i.e.*) a circle passing through the point at infinity the $w$ locus also passes through the point at infinity; in other words it is a circular cubic.

*Corollary.* For the system of conics touching four lines it is known that the pairs of foci belong to an involution and the centre locus is a straight line.[1] Hence the locus of the foci is a circular cubic.

**4.** Let us consider the $w$ loci when $\mu$ traces circles invariantly related to the points $\Delta$ ($\mu$). For this it is enough if we take up the simpler form $F_1$, provided the results are interpreted in an invariant manner, so that they may be true even after independent linear transformations of Z and $\lambda$ which carry $F_1$ to F.

(*a*) Consider as $\lambda$ loci the system of circles, passing through or having as inverse points the points $\Delta(\lambda)$

They are given by

$$a\lambda + \bar{a}\bar{\lambda} = 0, \text{ or } l\lambda\bar{\lambda} + b = 0.$$

Hence the $z$ locus is

$$a z^2 + \bar{a} z^2 = 0 \text{ or } l z^2 \bar{z}^2 + b = 0.$$

The $z$ locus breaks up into two mutually orthogonal circles, passing through or having as inverse points the points D ($z$). Hence for the general correspondence F,

*if the $\mu$ locus is a circle passing through, or having as inverse points the points $\Delta$ ($\mu$), the $w$ locus breaks up into two mutually orthogonal circles passing through or having as inverse points the points* D ($w$).

(*b*) Let us consider the net of circles orthogonal to a fixed circle having as inverse points the points $\Delta$ ($\lambda$).

It is given by $$l\lambda\lambda + a\bar{\lambda} + \bar{a}\bar{\lambda} + b = 0.$$

where $\frac{b}{l}$ is constant.

Hence $$l z^2 \bar{z}^2 + a z^2 + \bar{a} z^2 + b = 0.$$

All these cyclics are self-inversive with respect to the two fixed circles

$$\sqrt{l}\, z\bar{z} + \sqrt{b} = 0 \text{ and } \sqrt{l}\, z\bar{z} - \sqrt{b} = 0.$$

It is well known[2] that every cyclic is self-imversive with respect to four mutually orthogonal circles, which are called the director circles of the cyclic.

[1] Grace and Young. *Algebra of Invariants.* Page 208.

[2] Coolidge: *Treatise on the Circle and the Sphere*, page 206, Ganguli: *Theory of Plane Curves*, page 207.

*Hence to the net of circles orthogonal to a fixed circle having as inverse points the points* $\Delta(\mu)$ *corresponds a system of cyclics having in common two director circles, for which the points* $D(w)$ *are inverse points.*

(c) Similarly it can be shown that

*to the net of circles orthogonal to one passing through the points* $\Delta$ $(\mu)$, *corresponds a system of cyclics having in common two director circles, passing through the points* $D$ $(w)$

(d) Now we have a coaxal system of circles orthogonal to one passing through, and to another having as inverse points the points $\Delta$ $(\lambda)$ ; in other words it is a coaxal system whose limit-points belong to the involution defined by $\Delta$ $(\lambda)$. Hence combining (b) and (c) we have *corresponding to a coaxal system of circles having for its limit-points a pair of the involution defined by* $\Delta$ $(\mu)$, *we have as* $w$ *loci, a pencil of codirector subrational cyclics.*

5. Here let us take the $w$ locus to be a circle, and obtain the corresponding $\mu$ locus. The $z$ locus being a linear transform of the $w$ locus is also a circle, which can be taken to be

$$l z \bar{z} + a \bar{z} + a \bar{z} + b = 0 \quad (1)$$

But $z^2 = \lambda$. Hence substituting and rationalising we have:

$$(l^2 \lambda \bar{\lambda} - a^2 \lambda - \bar{a}^2 \bar{\lambda} + b^2)^2 = 4(a a - bl)^2 \lambda \bar{\lambda}.$$

Thus the $\lambda$ locus is a cyclic. It is obvious that we get the same cyclic, if we take the circles

$$l z \bar{z} - a z - \bar{a} \bar{z} + b = 0 \qquad (2)$$

$$l z \bar{z} + a z - \bar{a} \bar{z} - b = 0 \qquad (3)$$

$$l z \bar{z} - a z + \bar{a} \bar{z} - b = 0 \qquad (4)$$

This is as it ought to be; for since the locus of $\lambda$ is a (2, 2) curve, the locus of Z should be a (4, 4) curve which in this case breaks up into four circles. It can be easily shown that (2) is the mate of (1) in the involution defined by the correspondence, and (3), (4) are imaginary circles containing the cross pair of every pair of the involution on (1) and (2).

The $\lambda$ locus is a nodal cyclic with its two real foci at the points $\Delta(\lambda)$. It is well known that every cyclic has four real foci, which are obtained as the real points of intersection of the minimal lines of either system which touch it. The latter are given by the discriminants of the double-binary form, regarded as quadratics in $\lambda$ and $\bar{\lambda}$ respectively. These are found to be

$$4(a\bar{a} - bl)^2 (\bar{a} b - al \lambda)^2 \lambda = 0$$

and its conjugate.

Hence the real foci are the points

$$0, \infty, \frac{\bar{a}}{a}, \frac{b}{l}, \frac{\bar{a}}{a}, \frac{b}{l}.$$

Further the coincident foci $\frac{\bar{a}}{a}, \frac{b}{l}$ lies on the curve so that it is a node.

In fact the nodal point on the $\lambda$ locus corresponds to the unique pair of points on the Z circle belonging to the involution, which consists of two points real, coincident, or imaginary according as (Z) the origin lies within, on or outside the Z circle.

Hence interpreting for the general correspondence we have the following :—

*If the w locus is a circle, the $\mu$ locus is a nodal cyclic, with its two real foci at the points* $\triangle$ ($\mu$). *The double point is nodal, cuspidal or conjugate according as the w locus separates, passes through one of, or does not separate the points* D ($w$).

The following results analogous to those in Para 3 can be easily established :—

($a$) If the $w$ locus is a circle passing through or having as inverse points the points D ($w$), the $\mu$ locus is a circle passing through or having as inverse points the points $\triangle$ ($\mu$)

(*b and c*) If the $w$ circle belongs to a net orthogonal to a fixed circle passing through or having as inverse points the points D ($w$), the node of the $\mu$ cyclic lies on a fixed circle, passing through or having as inverse points the points D ($w$)

($d$) Combining ($b$) and ($c$). If the $w$ circle belongs to a coaxal system, whose limit-points form a pair of the involution defined by D ($w$), the node of the $\mu$ cyclic is a fixed point.

Lastly, it may be observed that since the centre $\gamma$ of the point pairs is only a linear transform of the parameter $\mu$, the above results are true, as well when $\gamma$ is taken instead of $\mu$,—the only speciality being the identity of the two quadratic covanants $\triangle$ ($\mu$) and D ($w$).

# Theorems on Ovals.*


By

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**1.** We shall consider a plane closed curve for which the tangent turns round continuously in the same direction and returns to itself after one complete revolution. We shall assume that no straight line cuts the curve in more than two points, and shall call such a curve an *oval.* It is known that an oval has two and only two tangents in any particular direction. Two points P, P′ of the oval are *opposite points* if the tangents at P and P′ are parallel. The distance between the tangents at P and P′ is called the *width* of the curve at P or P, and PP′ the *diameter* at P.

We shall in what follows assume that there exists a circle of curvature at each point of the oval, and that the radius of curvature P has a derivative. A point of the curve at which the curvature $k$ ($= 1/\rho$) is an extremum is called a *vertex* of the oval. At such a point, the circle of curvature has four points in common with the oval. On this account, a vertex is sometimes called a cyclic point. When the curvature of an oval is continuous, it is known that the oval has at least four vertices.†

**2.** We shall now prove.

*Theorem* **1.** *If an oval has exactly four vertices, they cannot all lie on a circle.*

We start with the following

*Lemma* : If $\mathbf{r}$ is the position vector to a point P on the oval C, and $k$ the curvature at the point,

$$\int_C (\mathbf{r}^2 + \mathbf{a}.\,\mathbf{r} + b)\, dk = 0,$$

where the integral is taken round the entire curve C, **a** is an arbitrary constant vector and $b$ an arbitrary constant.

This equation is really equivalent to the following three :

$$\int_C dk = 0, \quad \int_C \mathbf{a}.\,\mathbf{r}\, dk = 0, \text{ and } \int_C \mathbf{r}^2\, dk = 0, \qquad \ldots \quad (1)$$

The first equation follows from the fact that the curve C is closed and the curvature returns to its original value. To prove the others, we shall use the Frenet-Serret formulae for a plane curve, viz.,

$$\frac{d\mathbf{r}}{ds} = \mathbf{t}, \quad \frac{d\mathbf{t}}{ds} = k\,\mathbf{n}, \quad \frac{d\mathbf{n}}{ds} = -\,k\mathbf{t}, \qquad \ldots \quad (2)$$

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* I am extremely thankful to Mr. A. Narasinga Rao for suggestion and advice in the preparation of this paper.

† Mukhopadhyaya : *Bull. Calcutta Math. Soc.*, Vol., 1909 ; and Blaschke *Vorlesungen über Differentialgeometrie*, Vol. 1 p. 31 (1930).

where $\mathbf{t}$ and $\mathbf{n}$ denote unit vectors along the tangent and normal at the point P, and $ds$ is an element of the arc, *i.e.*,

$$d\mathbf{n} = -k\,\mathbf{t}\,ds = -k\,d\,\mathbf{r}, \text{ and } \mathbf{n}.\,d\mathbf{r} = \mathbf{n}.\,\mathbf{t}\,ds = 0 \quad \ldots \quad (3)$$

Hence on integrating by parts, we have

$$\int_C \mathbf{a}.\,\mathbf{r}\,dk = [k\,\mathbf{a}.\,\mathbf{r}]_C - \int_C k\,\mathbf{a}.\,d\mathbf{r} = -\int_C \mathbf{a}.\,kd\mathbf{r},$$

since $k$ and $\mathbf{a}.\,\mathbf{r}$ return to the same values after $\mathbf{r}$ describes the whole curve C,

$$= -\int_C \mathbf{a}.\,d\,\mathbf{n} = [\mathbf{a}.\,\mathbf{n}]_C = 0.$$

Similarly, $$\int_C \mathbf{r}^2\,dk = -2\int_C k\,\mathbf{r}.\,d\mathbf{r} = 2\int_C \mathbf{r}.\,d\mathbf{n}$$

$$= -2\int_C \mathbf{n}.\,d\mathbf{r} = 0 \quad \text{by (3).}$$

Let us now suppose that the four vertices of the oval C are P Q R and S. If possible, let P, Q, R, S lie on a circle whose centre is O and radius $d$.

If $\mathbf{c}$ is the position vector of O, the equation of the circle P Q R S is

$$(\mathbf{r}-\mathbf{c})^2 - d^2 = \mathbf{r}^2 - 2\,\mathbf{r}.\,\mathbf{c} + \mathbf{c}^2 - d^2 = 0 \quad \ldots \quad (4)$$

The quantity $\mathbf{r}^2 - 2\,\mathbf{r}.\,\mathbf{c} + \mathbf{c}^2 - d^2 = (\mathbf{r}-\mathbf{c})^2 - d^2$ is positive for points outside the circle and negative for points inside it. Hence when $\mathbf{r}$ denotes the position vector of a point on the oval, $(\mathbf{r}-\mathbf{c})^2 - d^2$ changes sign only at a common point of the oval and the circle P Q R S *i.e.* only at P, Q, R and S, since the a circle cannot have more than four common points with an oval which has only four vertices.* Also since P, Q, R, S are the vertices of the oval, $\frac{dk}{ds}$ change sign only at each of the vertices. Therefore the product $\left\{(\mathbf{r}-\mathbf{c})^2 - d^2\right\}\frac{dk}{ds}$ keeps the same sign for all points on the oval, and the integral $\int_C \left(\mathbf{r}^2 - 2\,\mathbf{r}.\,\mathbf{c} + \mathbf{c}^2 - d^2\right)\frac{dk}{ds}$ cannot vanish. But this contradicts our Lemma when $\mathbf{a} = -2\,\mathbf{c}$ and $b = \mathbf{c}^2 - d^2$.

Thus if an oval has exactly four vertices they can never lie on a circle.

In fact, it can be proved in the same way that if an oval has exactly $n$ vertices, these cannot all be concyclic.

* Blaschke ; *Vorlesungen uber Differentialgeometrie* Bd. 1 p. 49 Ex. 21, (1931).

**3.** *Theorem 2. The medial locus i.e., the locus of the midpoints of the diameters of an oval is a closed curve. The tangent at any point Q of the medial is parallel to the tangents at the extremities P, P′ of the diameter which is bisected at Q. The radius of curvature of the medial at Q is equal to half the difference of the radii of curvature at P and P′.*

Let **t** and **n** be the unit tangent and normal vectors at a point P whose position vector is **r**. The corresponding letters with the addition of a prime shall be taken to refer to the opposite point P′.

The tangents at P and P′ being parallel, $\mathbf{t}' = -\mathbf{t}$,

Also
$$\mathbf{r}' = \mathbf{r} + \mu\,\mathbf{n} + \lambda\,\mathbf{t}, \qquad \ldots \qquad (5)$$

where $\mu$ is the width of the curve at P or P′. Differentiating with respect to $s$

$$\frac{d\mathbf{r}'}{ds} = \frac{d\mathbf{r}}{ds} + \mu\,\frac{d\mathbf{n}}{ds} + \lambda\,\frac{d\mathbf{t}}{ds} + \mathbf{n}\,\frac{d\mu}{ds} + \mathbf{t}\,\frac{d\lambda}{ds}$$

Using the formulae (2) above, we have

$$\frac{d\mathbf{r}'}{ds} = \mathbf{t}\left(1 - k\,\mu + \frac{d\lambda}{ds}\right) + \mathbf{n}\left(k\,\lambda + \frac{d\mu}{ds}\right),$$

where $k = 1/\rho$ is the curvature of the oval at P.

Since
$$\frac{d\mathbf{r}'}{ds} = \frac{d\mathbf{r}'}{ds'}\,\frac{ds'}{ds} = \mathbf{t}'\,\frac{ds'}{ds} = -\,\mathbf{t}\,\frac{ds'}{ds'}$$

$$-\,\mathbf{t}\,\frac{ds'}{ds} = \mathbf{t}\left(1 - k\,\mu + \frac{d\lambda}{ds}\right) + \mathbf{n}\left(k\,\lambda + \frac{d\mu}{ds}\right)$$

$$\therefore\ -\,\frac{ds'}{ds} = 1 - k\,\mu + \frac{d\lambda}{ds}, \qquad \ldots \qquad (6)$$

and
$$k\,\lambda + \frac{d\mu}{ds} = 0\,. \qquad \ldots \qquad (7)$$

If $\theta$ be the angle that the tangent at $\rho$ makes with a fixed direction,

$$ds = \rho\,d\,\theta, \qquad ds' = \rho' d\,\theta \text{ since } d\,\theta = d\,\theta'.$$

$$\therefore\ (\rho+\rho')\,d\,\theta = ds + ds' = k\,\mu\,ds - d\lambda \qquad \text{from (6)}$$

$$\therefore\ \rho+\rho' = \mu - \frac{d\lambda}{d\theta} \qquad \ldots \qquad (8)$$

Now if **m** is the position vector of the mid point Q of the diameter PP′,

$$\mathbf{m} = \tfrac{1}{2}(\mathbf{r} + \mathbf{r}') = \mathbf{r} + \tfrac{1}{2}(\mu\,\mathbf{n} + \lambda\,\mathbf{t}) \qquad \text{by (5)}$$

Differentiating with respect to $s$, we have, as before,

$$2\frac{d\mathbf{m}}{ds} = \mathbf{t}\left(2 - \mu k + \frac{d\lambda}{ds}\right) + \mathbf{n}\left(k\lambda + \frac{d\mu}{ds}\right)$$

$$= \mathbf{t}\left(2 - \mu k + \frac{d\lambda}{ds}\right) \qquad \text{by (7)}$$

$$= \mathbf{t}\left(1 - \frac{ds'}{ds}\right) \qquad \text{by (6)}$$

$$= \mathbf{t}\left(1 - \frac{ds'}{d\theta}\,\frac{d\theta}{ds}\right)$$

$$\therefore\ 2\frac{d\mathbf{m}}{ds} = \mathbf{t}\left(1 - \frac{\rho}{\rho'}\right) \qquad \ldots \qquad (9)$$

This shows that *the tangent to the medial at Q is parallel to the tangent to the oval at* P. If we take a unit tangent vector $\mathbf{t}_m$ at Q in the same sense as $\mathbf{t}$, we have, if $s_m$ be the arc of the medial,

$$\mathbf{t}_m = \frac{d\mathbf{m}}{ds_m} = \mathbf{t},$$

and

$$2\frac{d\mathbf{m}}{ds} = 2\frac{d\mathbf{m}}{ds_m} = \frac{ds_m}{ds} = 2\,\mathbf{t}\,\frac{ds_m}{ds}$$

Hence equation (9) becomes

$$2\mathbf{t}\,\frac{ds_m}{ds} = \mathbf{t}\left(1 - \frac{\rho'}{\rho}\right)$$

$$\therefore\ 2\frac{ds_m}{ds} = 1 - \frac{\rho'}{\rho} \qquad \ldots \qquad (10)$$

The tangent to the medial at Q being parallel to the tangent to the oval at P, the angle turned through by the tangent to the medial, $d\theta_m = d\theta$. and if $\rho_m$ is the radius of the curvature of the medial at Q, we have

$$\frac{ds_m}{ds} = \frac{ds_m}{d\theta_m}\,\frac{d\theta}{ds} = \frac{\rho_m}{\rho},$$

and therefore, from equation (10), we have

$$\frac{2\rho_m}{\rho} = 1 - \frac{\rho'}{\rho}$$

or

$$\rho_m = \tfrac{1}{2}(\rho - \rho') \qquad \ldots \qquad (11)$$

Now as P moves along the oval, the mid point Q of PP′ describes the medial and when the tangent at P turns round in the same direction through 180° P comes to P′ and P′ to P. Q therefore returns to its original position. When P describes the other arc of the oval, P′ describes the original arc

described by P, and Q therefore goes through the same positions as before. The medial curve is thus closed and is described twice as the point P moves round the entire oval once.

**4.** *Theorem* 3. *The necessary and sufficient condition that an oval has a centre (i.e., a point which bisects every chord through it) is that the curvatures at every pair of opposite points are equal.*

If an oval has the centre O, and any chord through O meets it in P P′, the neighbourhood of the curve at P′ is obtained by rotating a small arc in the neighbourhood of P through 180° about O. Hence the tangents at P and P′ are parallel, and the curvatures at P, P′ are equal.

The condition is also sufficient, for if in equation (9) we put $\rho = \rho'$,

$$\frac{d\,\mathbf{m}}{ds} = 0,$$

*i.e.*, $\mathbf{m}$ is a constant vector.

All the diameters of the oval pass through and are bisected at the fixed point $\mathbf{m}$, which is therefore the centre of the curve.

**5.** If a curve is of constant breadth, $\mu$ is constant, and from (7) it follows that $\lambda = 0$. Hence from (8),

$$\rho + \rho' = \mu, \text{ a constant}$$

If in addition the curve has a centre, $\rho = \rho'$, according to Theorem (3) and therefore

$$\rho = \rho' = \frac{\mu}{2}$$

Hence.

*if a curve of constant breadth has a centre, it is necessarily a circle.*

# Anatomy of *RACHISELLUS PUNCTATUS* (ANTON).

By

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*Rachisellus punctatus* is a small Stylommatophorous Pulmonate, partly arboreal in habits, and easily recognised by the elongate shell with a dark red infra-peripheral band on the body whorl of the shell.

The genus *Rachisellus* was first established by Bourguignat in 1889. Dr. Thiele considered it as a sub-genus of *Ena* (Fam. Enidae), basing his conclusions on certain radular features. Gude (3) retained it as an independent genus of Enidae, considering the features of the shell. But, no anatomical investigations have been made on the genus. We have, however, a brief account of the habits of the species under the synonomy of *Rachis punctatus* by Ramanan (4). The present paper gives an account of the anatomy of the species.

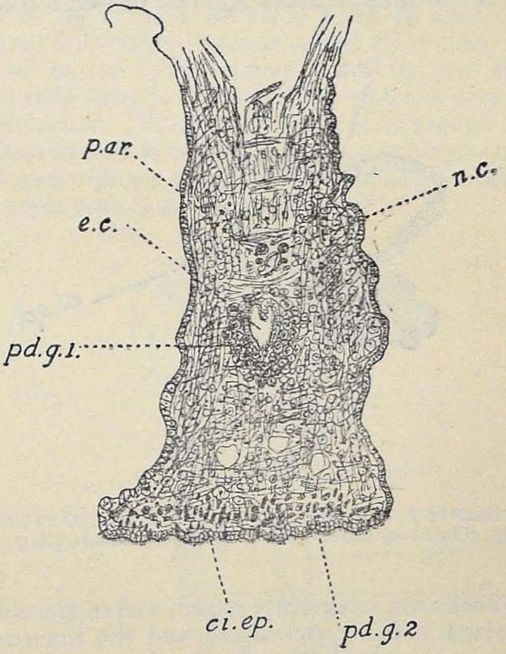
In distribution, the genus is confined to India and tropical Africa. In South India, the species has been recorded till now from Madras, Trichinopoly, Nullamalays and Travancore. I have come across this species in Chittoor, Cuddapah, Godavery and Nellore districts. The specimens for the present investigation were collected from the Madras High Court park, where they were found in the crevices in the bark of trees, chiefly of the species *Morinda tinctoria*. During the hot weather, the animals burrow into the bark of trees and remain for months in a comatose condition. After a good shower of rain they come down and can be seen crawling on grass and other vegetation on the ground.

### *The Animal.*

The maximum measurements of the shells which I have come across are as follows:—length 15 mm. ; diameter 7 mm.; aperture 6 mm. long and 4 mm. broad. The body of the animal consists of four and a half to five whorls and, like that of all Gastropods in general, is divisible into the head, foot and visceral mass. The head, foot and the free edge of the mantle are the only parts that are usually protruded out of the shell in the living animal. The general colour of the head and foot is light yellowish brown. The animal is somewhat semitransparent, chiefly in the anterior region, and in an animal asphyxiated in water, the position of the buccal mass, the nerve centres and the retractors of the posterior tentacles can be made out through the thin body integument. The integument on the head and the dorsal surface of the foot shows minute and thickly set tubercles. The course of the intestine and the ureter and the mantle blood vessels can be seen in the body whorl through the thickness of mantle. The kidney is seen at the apex of the body whorl towards the left, and has a light yellow colour in the living animal. The pericardium is situated immediately to the left of the kidney. The upper or the dorsal side of the remaining whorls is greyish white in colour, while the columellar side is greenish brown.

The head is not distinctly marked off from the foot. It is crescentic in section and bears the mouth and the two pairs of tentacles, the posterior of which bear the eyes and measure about 9 mm. On the right side of the head, immediately below the posterior tentacles, is situated the elliptic genital aperture. The region of the genital aperture appears blackish brown in colour, and this is due to the colour of the genital cloaca inside.

The integument over the head consists of rather short and somewhat cylindrical epithelial cells with gland cells between them. Gland cells which open on the surface are also found immediately below the epithelium. Beneath the epithelium are found connective tissue, blood spaces and transverse and longitudinal muscle fibres.

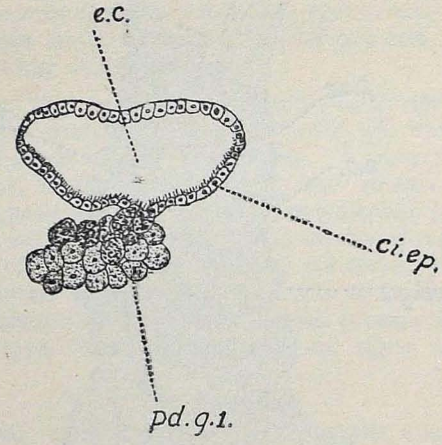



Text-fig. 1.—Vertical section through the contracted foot. ci. ep. ciliated epithelium; e. c. excretory canal of the pedal gland; n.c. pedal nerves; p. ar. pedal artery; pd. g. 1 pedal gland; p. d. g. 2, scattered gland-cells.

The foot measures about 16 to 19 mm. in the fully extended condition. It is somewhat lanceolate in shape with the broad end directed forward. When the foot is observed while the animal is in progression, a series of peristaltic contractions from behind forwards can be observed, and, as the animal moves forward, a trail of mucus, the secretion of the pedal gland, is left behind. The foot is covered by columnar epithelium, which on the ventral surface is ciliated. The main mass of the foot is muscular, being composed of three sets of muscle fibres, the vertical, or dorsoventral, the lateral, or transverse and the longitudinal.

The transverse fibres are more conspicuous in the upper part of the foot. Between the muscle fibres, there is connective tissue in which the pedal blood vessels and the pedal nerves lie.

The foot possesses two types of glands, the scattered unicellular mucous glands and the supra-pedal gland. The unicellular glands are numerous near the ventral epithelium and open on the ventral surface. The central pedal gland is about two thirds of the length of the foot. Anteriorly, it lies in the upper part of the foot and is separated from the body cavity by only a few muscle fibres, while posteriorly it comes to lie in the central part of the foot. In *Milax* the excretory canal has an investment of the gland only on the ventral surface, whereas in *Rachisellus* both the dorsal and ventral surfaces are covered by the gland. In some cases, the posterior part of the canal has only a sparse investment of the gland. A few muscle fibres and one or two blood vessels are seen in the gland.




Text-fig. 2.—Excretory canal of the pedal gland as seen when the muscles of the foot are relaxed. ci. ep. ciliated epithelium; e. c. excretory canal; pd. g. 1. cells of the pedal gland.

The gland cells are irregularly round, and in the cells without secretion, the cytoplasm is finely vacuolated and the nucleus, which is round and deep-staining, is centrally placed. In the actively secreting cells, the cytoplasm is filled with deep staining secretion which obliterates the cellular details. The secretion of the cells passes into the excretory canal.

The excretory canal in the pedal gland in *Rachisellus* is simple as compared with that of *Milax*, where it is said to be branched. It is more or less surrounded by the pedal gland, especially in the anterior part. It is slightly shorter than the gland and does not extend quite to the posterior end of the gland. The ventral epithelium shows, sometimes, a slight groove in the middle and is composed of short cells with cilia at their free ends, and with prominent, basally placed round nuclei. The dorsal epithelium of the canal is non-ciliated and shows in some places a proliferation of cells looking like a typhlosole. In specimens showing this feature the canal is narrow and the foot is contracted laterally. In

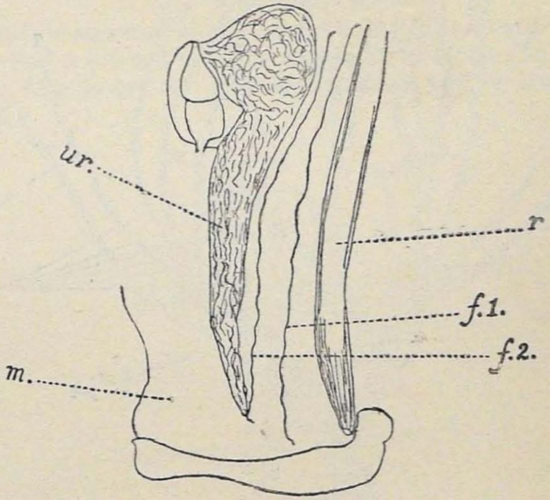
preparations in which the lateral muscles of the foot are found relaxed, the canal appears wide and without the dorsal thickening of the epithelium, which is evidently due to the contraction of the foot. No concretions were observed in the canal.

The expulsion of the mucus in the canal can be brought about not only by the action of the cilia in the canal, but also by the contraction of the foot as a whole squeezing the gland, and by the contraction of the muscle fibres among the gland cells.

The pedal artery is situated immediately dorsal to the pedal gland, and above the artery are the pedal nerves.

*The Mantle and the Mantle Cavity.*

The mantle shows the usual features characteristic of the terrestrial Pulmonates and forms a cloak which is fused all round with the body, leaving only a small pulmonary opening on the right side. Ventrally the mantle is attached to the foot, leaving free a narrow fringe of about 1.5 mm., while dorsally there is a wider fringe which is very thick and constitutes the mantle collar. The mantle collar is covered by ciliated columnar cells, both dorsally and ventrally, while the thickness is made of connective tissue, muscle fibres, blood spaces and large calcareous glands, often with solid secretions lying in vacuoles.



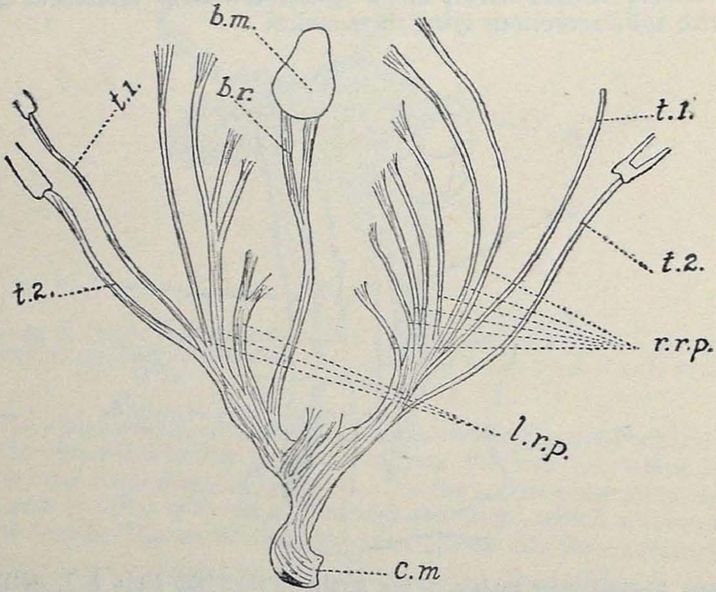

Text-fig. 3.—The inner surface of the mantle to show the folds. f. 1. rectal fold; f. 2. renal fold; m. mantle; r. rectum; ur. ureter.

The mantle cavity contains the rectum, the ureter and a plexus of blood vessels. The renal aperture is situated about 2 mm. from the mantle margin. At the apex of the mantle cavity the pericardium and the kidney are situated. The inner epithelium of the mantle between the ureter and the rectum is thrown into two longitudinal folds. The one near the ureter starts from behind the renal opening and runs up as far as the kidney. It lies more or less parallel to the ureter

throughout its length. The one on the rectal side is wider, and starting from the mantle collar runs parallel to the rectum. The general outer surface of the mantle,is formed by somewhat columnar cells with round unclei, while the thic kness of the mantle is made of longitudinal and transverse muscle fibres and connective tissue with blood spaces and gland cells. The inner epithelium of the mantle has somewhat shorter cells. The folds between the rectum and the kidney are formed from the epithelium of the inner surface of the mantle. Each of these folds has a double layer of epithelial cells continuous with the inner epithelium of the mantle and having between the two layers connective tissue and blood spaces. The blood spaces are continuous with the venous vessels passing from the rectal sinus to the kidney along the roof of the mantle. These folds probably serve for increasing the respiratory surface, and, in vertical sections, bear a slight resemblance to the gill lamellae of an aquatic Gastropod, although they do not possess the characteristic ciliated cells.

*The Muscular System.*

The muscular system of *Rachisellus*, which, like those of other Pulmonates, is well developed, consists chiefly of the columellar system with the various retractors originating from it, and the muscles of the




Text-fig. 4.—The retractor muscles of *Rachisellus punctatus*. b. m. buccal mass; b. r. buccal retractor; c. m. columellar muscle; l. r. p. pedal retractors of the left side; r. r. p, retractors of the right side; t. 1. retractor of the anterior tentacle; t. 2. retractor of the posterior tentacle.

buccal mass. The intrinsic muscles of the buccal mass will be considered under the digestive system. The buccal retractor arises from the columellar system and soon divides into two sets which pass forwards through the circumoesophageal nerve ring to the ventral surface of the buccal mass, one on either side of the middle line.

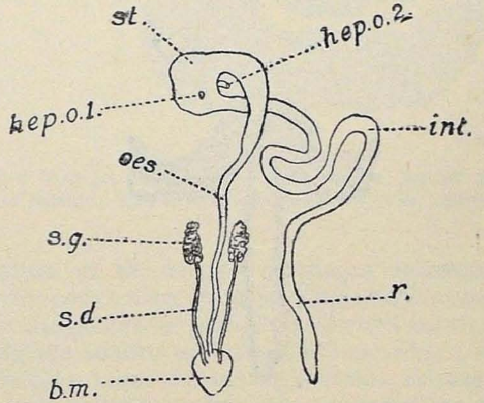
The columellar muscle is broad, shining white and spirally disposed. It extends posteriorly to the region of the stomach, where it is attached to the columella. From the columellar muscle two chief sets of muscles arise, a right and a left one. The left one gives off the buccal retractors and a little further forwards, the pedal and the tentacular retractors of the left side. The posterior tentacular retractor is thicker than the anterior and is reddish in colour. The left pedal retractors are composed mainly of five sets of muscles, two anterior, two median and one posterior. The posterior, one near its insertion, usually breaks up into two sets. The anterior retractors are attached to the lateral region of the foot. The median retractors are attached to the foot mostly above the level of the pedal ganglia. The posterior one is attached a little behind these.

The right set of retractors consists of about nine muscle strands. The outermost one, like the one on the right side, is thick and measures about 7 mm. The next one is a slender strand and is the anterior tentacular retractor. Of the remaining seven, two are anterior, four median, and one posterior.

Besides these retractors, muscle fibres from the columellar muscle pass through the mantle edge on the ventral side to the hind part of the foot.

*The Alimentary Canal.*

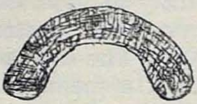
The mouth is situated at the anterior end of the head and is bounded by an upper and a lower lip. The upper lip is crescentic and has a low frilled edge. The lower lip possesses a deep groove leading into the




Text-fig. 5.—Outline diagram of the alimentary canal. b. m. buccal mass; hep. o. 1. opening of the posterior duct of the digestive gland: hep. o. 2. anterior duct of the digestive gland; int. intestine; oes. oesophagus; r. rectum; s. d. salivary duct; s. g. salivary gland; st. stomach.

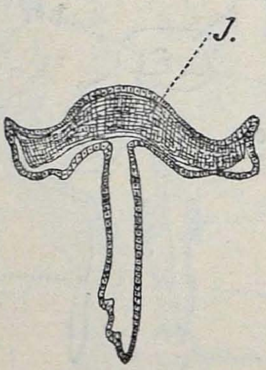
oral cavity. In vertical section the mouth is T-shaped and the jaw, which is situated in the upper part of the mouth, is brown in colour and crescentic in shape. It stains feebly and shows minute and faint transverse and vertical lines.

The lining of the mouth is formed by cylindrical cells with oval nuclei and interspersed flask-shaped gland cells. The gland cells are more numerous in the vertical part of the mouth. In the connective tissue above the oral cavity, a few cartilage-like connective tissue cells are found. In the oral region of the head, on either side, are found masses of mucous cells which are similar in structure to those found in the pedal gland.



Text-fig. 6.—The jaw.

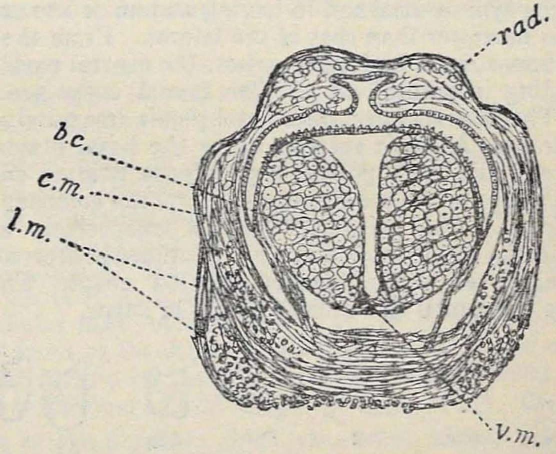
The mouth leads into the buccal cavity. The buccal mass, which is oval in shape, measures about 2 mm. by 1.5 mm. and is well provided with intrinsic as well as extrinsic muscles. Arising from the anterior end of the buccal mass, from just behind the region of the jaw, are a number of slender thread-like muscles which run upwards and forwards to be attached to the dorsum of the oral region of the head. These are the protractors of the anterior part of the buccal region and some of them are median, and others, lateral. Arising from the dorsolateral aspect of the buccal mass, there is, on either side, a long slender protractor muscle which runs forwards and upwards and becomes attached to the antero-dorsal part of the cephalic region. Arising from the ventro-lateral aspect of buccal mass is a long, fairly broad muscle which runs forwards to be attached near the base of the small tentacle. Arising from either side of the middle line of the ventral surface, are three muscles which run forwards.




Text-fig. 7.—Section through the oral region; j. jaw.

As for the intrinsic muscles, on the ventral surface are bundles of longitudinal muscles running from the hind end forward, and inside of these are circular muscles which are especially developed round the anterior part of the buccal mass. A few lateral longitudinal muscles are found to the inside of these, and in their turn overlie a few circular muscles. On the dorsal side between these muscles some connective tissue is found.

The buccal cartilages are two in number and united in front, both dorsally and ventrally. Their front ends are at a higher level than the hind ends. The cartilages are somewhat oval in outline, when viewed from above. A transverse section through the anterior part of the buccal cavity shows the buccal cartilages as a single circular mass. A little behind, the two cartilages are partly separate with a cavity between them, but are united dorsally and ventrally. A little further back they are free, both dorsally and ventrally. In the posterior part, the buccal cartilages appear pyriform in transverse section. As for the minute structure, each cartilage is composed of irregularly oval cells with non-staining cytoplasm and small roundish nuclei and distinct nucleoli. Between these cells connective tissue fibres are noticed traversing from side to side. They are abundant especially in the dorsal region of the anterior part of the cartilages. In the presence of these connective tissue fibres the buccal cartilages differ from the type usually met with in Prosobranches.



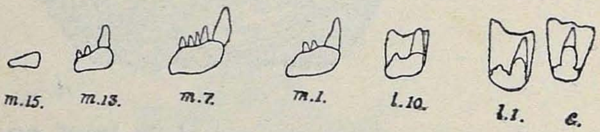

Text-fig. 8.—Section through the anterior part of the buccal mass. b. c. buccal cartilage; c. m. circular muscles; l. m. longitudinal muscles; v. m. ventral muscles connecting the cartilages.

The musculature of the buccal cartilages consists chiefly of the dorso-lateral muscles connecting the cartilages and the elastic membrane, best developed in the posterior part of the buccal mass, and the ventral muscles connecting the ventral surface of the cartilages, best seen in the anterior part. Besides these there are muscles arising ventrally and inserted on the dorso-lateral surface of each cartilage and seen in the anterior region. In the posterior region of the buccal mass, longitudinal muscles running on the inner surface of the cartilages and extending to the elastic membrane are seen.

The oral aperture, it has already been said, is T-shaped. Posteriorly, in the buccal cavity, the upper, horizontal part of it becomes short and the vertical portion also becomes short but develops lateral arms which dip down besides the buccal cartilage of either side. The buccal epithelium resembles in general the oral epithelium.

The radular sac has an investment of thin connective tissue and muscle fibres. The odontoblasts are nearly cylindrical with homogeneous cytoplasm and round nuclei.

Gude (3) states that, according to Schacko, the radula of a specimen of *Rachisellus punctatus* is reported to have the following features: "Central, tricuspid, very small; laterals, strong with a largely obliquely central plate, marginals, very abundant with seven side cusps". This description, I find to be incomplete and not corroborated by my observations. An examination of the radulae of several specimens shows the following constant features. The radula is nearly of the same width throughout and the radular formula is approximately 15. 10 or 11. 1. 10 or 11. 15. and there are about 105 transverse rows. The central is slightly small but not at all very small as described by Schacko. In fact, there is not much appreciable difference between it and the laterals. The central usually measures about 20$\mu$ and the laterals also are very nearly of the same size. The central differs from the laterals mainly in being symmetrical and in having a more or less trapezoid basal plate which is narrower than that of the lateral. From the basal part of the plate a three-cusped projection arises, the central part being prominent and ending in pointed cusp. The lateral cusps are very slightly developed. The laterals have their basal plates irregularly or obliquely truncate in front. At their anterior edges the basal plates are pointed on one side, and the teeth possess a prominent pointed entocone and a smaller blunt ectocone. In the outermost lateral the ectocone is sometimes better developed. The marginals have a transversely elongate, and obliquely quadrate basal plate carrying a prominent entocone and usually three to five, never seven, smaller pointed cusps. The outermost marginals are very small and usually devoid of cusps.




Text-fig. 9.—Teeth of the radula. c. central; l. lateral; m. marginal.

The radula of *Rachisellus punctatus* has been said to closly resemble that of *Ena obscura* whose description is given as follows in the Fauna of India volume: "Radula leaf-like, attenuated posteriorly, bearing fifty longitudinal and 125 transverse rows of teeth; middle smaller than the laterals, with square basal plate and hooked middle cusp, which is short, conical and simple; laterals with pointed base and one or two short side cusps." As remarked above, the central in *Rachisellus* is only slightly smaller than the laterals and the basal plate is not square.

The oesophagus arises dorsally from the posterior part of the buccal mass and then descends to pass through the oesophageal nerve collar. The oesophagus in front of the nerve collar is 2 mm. and the length of the entire oesophagus is about 9 mm. As it approaches the stomach, it widens and gradually passes into the stomach. It is surrounded by connective tissue and circular muscle fibres and its inner epithelium is thrown into longitudinal folds, usually from five to eight

in number and which, in transverse section, appear as villi-like structures. The cells of the oseophageal epithelium possess short cilia-like structures of the type of rodlets. Gland cells are found between the epithelial cells.

The stomach is roughly U-shaped and thin-walled. On its ventral surface is the posterior opening of the digestive gland. The epithelium of the stomach is composed of non-ciliated cylindrical cells with numerous gland cells between them. The intestine, after leaving the stomach, takes a double loop and passing through the mantle cavity as the rectum, opens near the mantle margin. The rectal part of the intestine measures about 10 mm. The cells of the intestinal epithelium are similar to those of the oesophagus. The first part of the intestine shows a typhlosole. In the rectal part gland cells are very abundant.

The salivary glands are thin, foliate and somewhat triangular in outline. They lie on the oesophagus on the ventral and lateral aspects. The salivary ducts are long, measuring about four to five millimetres. They pass through the circumoesophageal commissure and enter the buccal mass on the dorsal surface, immediately in front of the buccal ganglia.

The salivary glands are composed of large round cells with somewhat excentric nuclei and reticular, deep-staining cytoplasm. The salivary ducts are lined inside by rather short ovoid cells.

The digestive gland is partly situated between the coils of the intestine. The gland extends from the third whorl to the apex. It may be described as consisting roughly of two lobes, an anterior one and a posterior one. The anterior lobe extends from the posterior end of the kidney to the stomach. The posterior lobe extends from the stomach to the apex of the body and invests the stomach like a cap. Each lobe consists of lobules made of the tubules of the digestive gland. There are two main ducts of the digestive gland, the posterior of which opens on the ventral surface of the stomach, while the anterior duct opens between the oesophageal and intestinal openings.

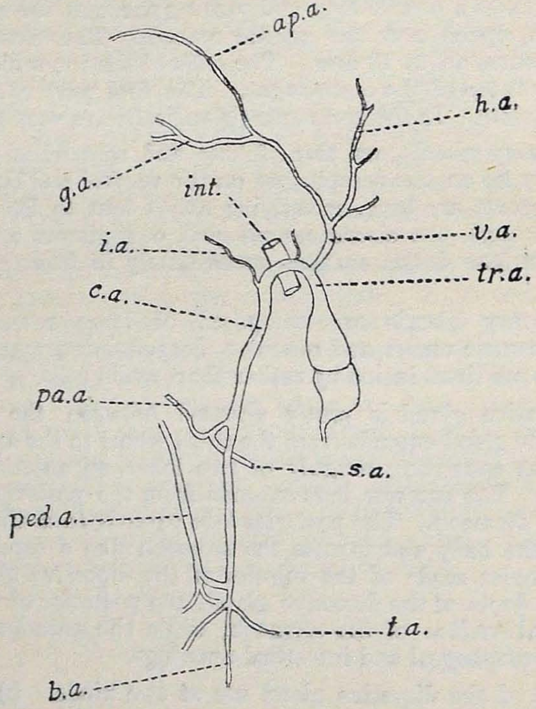
The cells of the digestive gland are of two kinds, (i) large ovoid gland cells with reticular or vacuolated cytoplasm and large round nuclei placed in the basal part (ii) and cylindrical ferment cells with granular cytoplasm and greenish brown spherical solid secretions often enclosed in vacuoles. The cylindrical cells project into the cavity of the tubule, much beyond the ovoid cells. The epithelium of the ducts of the digestive gland is folded.

### *The Circulatory System.*

The pericardium is thin-walled and triangular in outline and measures about 2 mm. by 1·5 mm. The heart consists of a single conical ventricle and of an oblong auricle. The ventricle, as usual, possesses thick muscular walls, while the auricle has thin walls. The auriculo-ventricular opening is guarded by two semi-lunar valves which spring from the commencement of the ventricle.

The ventricle gives rise to a short truncus arteriosus which branches into the two chief arteries, the anterior, or cephalic aorta and the posterior, or, visceral aorta. At the commencement of the truncus arteriosus

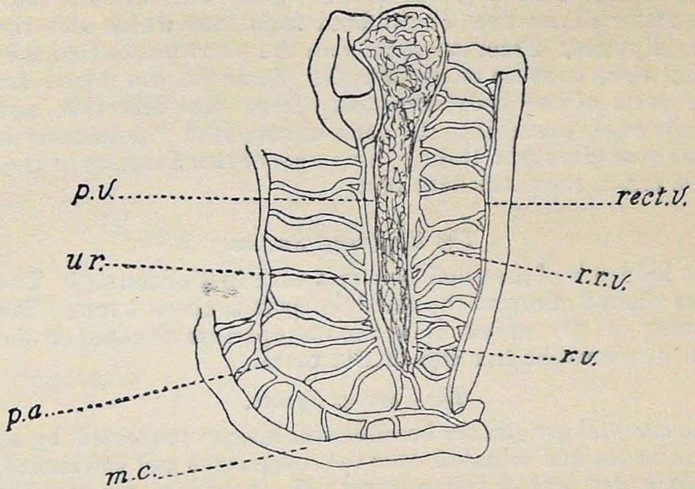
there is a valve. The visceral aorta divides into two chief branches, one of which constitutes the hepatic artery. The other branch sub-divides into two principal vessels, one of which is long and runs to the apex of the animal, supplying blood to the genital gland and the apical portion of the digestive gland, while the other branch forms the gastric artery which passes to the stomach and divides into two small arteries on its ventral surface.



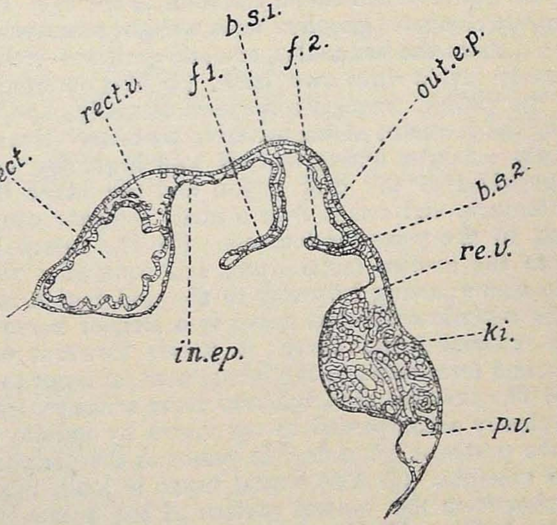

Text-fig. 10.—The chief arteries. ap. a. apical artery ; b. a. buccal artery ; c.a. cephalic or anterior aorta ; g. a. gastric artery ; h. a. hepatic artery ; int. intestine ; i. a. artery running on the intestine ; pa. a. pallial artery ; ped. a. pedal artery ; s. a. branch to the salivary glands ; t. a. tentacular branch ; tr. a. truncus arteriosus ; v. a. visceral or posterior aorta.

The cephalic or anterior aorta passes over the intestine and proceeds forwards to the anterior region of the body, giving off a number of smaller arteries. Immediately after passing over the intestine, it gives off a small artery which runs on the intestine. A little posterior to the region of the salivary glands, the aorta gives off a branch which sub-divides into two small arteries, one going to the salivary glands, and the other, to the mantle collar. After giving rise to these branches, the main vessel passes through the oesophageal nerve collar and branches into three chief arteries, a median one which is the buccal artery, and two lateral ones which go to the tentacles. A little behind the origin of these vessels, a ventral vessel arises and leads to the pedal artery. The pedal artery gives off two branches to the anterior part of the foot and posteriorly runs to the hind end of the foot.

The arteries are lined by flat endothelial cells with round nuclei and are invested on the outside by muscle fibres and a thick coat of large connective tissue cells.




Text-fig. 11.—Circulation in the mantle. m. c. mantle collar; p. a. vena circularis; p. v. pulmonary vein; rect. v. rectal vein; r. r. v. recto-renal vessels: r. v. renal vein; ur. ureter.




Text-fig. 12.—Section through the roof of the mantle cavity. b. s. 1. blood space in the mantle; b. s. 2. blood space in the fold of the inner epithelium of the mantle; f. 1., f. 2. folds of the inner epithelium of the mantle; in. ep. inner epithelium; ki. kidney; out. ep. outer epithelium; p. v. pulmonary vein; rect. rectum; rect. v. rectal vein; re. v. renal vein.

The venous blood collects into sinuses. The sinuses from the head and foot unite and similarly those from the viscera unite. The blood

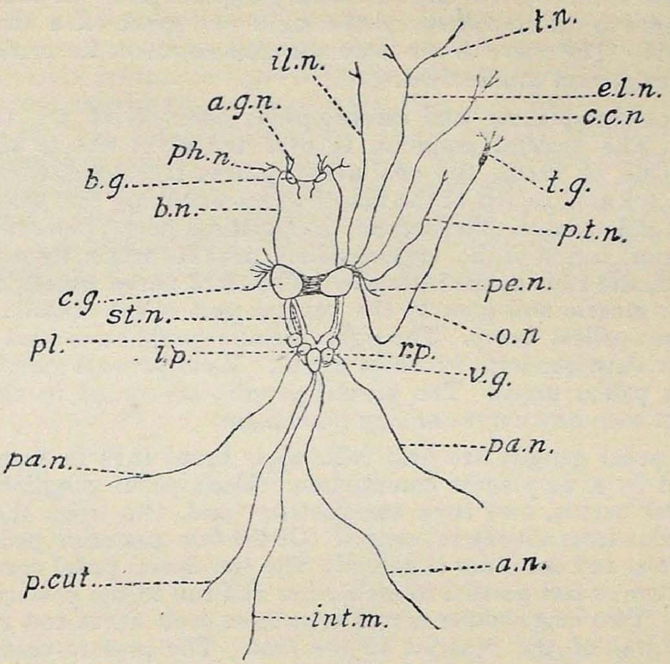
from these passes mostly into the rectal vein surrounding the rectum in the mantle cavity. From the rectal vein the blood passes into the renal vein through a number of ramifications in the roof of the mantle cavity. As has been shown already, the mantle epithelium between the rectum and the ureter shows two longitudinal folds into which also the recto-renal blood passes. From the renal vein the blood passes into the pulmonary vein which runs up to the auricle. Some of the blood from the anterior parts of the body, especially from the left side and from the mantle edge, passes into the vena circularis or "pulmonary artery". From the vena circularis, through a number of ramifications in the mantle the blood enters the pulmonary vein.

### *The Excretory System.*

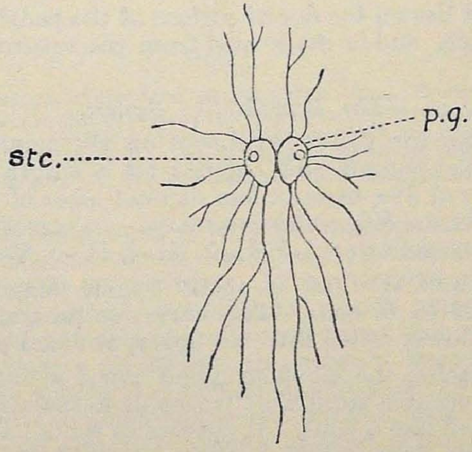
The kidney is of the usual type met with in Pulmonates. The ureter measures about 9 mm. and the glandular part is about 4 mm. The external opening of the ureter is a circular aperture situated on the rectal side, a little above the free end of the ureter.

### *The Nervous System.*

The cerebral ganglia are broadly oval masses connected by a brownish commissure and situated over the oesophagus and the buccal retractors. Each cerebral ganglion gives off anteriorly six chief nerves. (1) The optic nerve is a stout one and arises from the antero-dorsal edge of each cerebral ganglion. It bends round the cerebral ganglion and passes along the posterior tentacular retractor to the eye. In the tentacle it enlarges into an elongate ganglion with a slight transverse constriction in the middle. From the tentacular, or optic ganglion three nerves arise and immediately divide into two each. (2) The external labial nerve arises from the ventral surface somewhat laterally, and runs forward accompanying the retractor of the anterior tentacle. Near the anterior end it slightly enlarges and gives off two branches, one of which passes to the sides of the oral region and the other branch enters the anterior tentacle and swells into a small elongate ganglion, similar to that found in the posterior tentacle. (3) The internal labial nerve arises close to the median labial nerve and somewhat ventrally to it. It is a slender nerve passing forwards to the oral region and the lower lips. (4) The cephalo-cutaneous nerve is a slender nerve which arises close to the external labial nerve; it passes forwards ventral to the genital cloaca and terminates in the integument, anterior to the posterior tentacle. (5) The external peritentacular nerve arises ventral to the optic nerve and is closely accompanied in its course by muscle fibres of the retractor of the posterior tentacle. It passes to the peripheral region of the posterior tentacle. (6) The buccal nerve is long, measuring about 2 mm. and arises from the ventral surface of the antero-lateral edge of each cerebral ganglion. The buccal ganglia are oval and are separated by a long commissure. The long axis of each buccal ganglion is antero-posteriorly directed, and from the anterior end two nerves, the anterior gastric and the primary pharyngeal nerves arise. From the hind end, the ganglion gives off a small posterior gastric nerve. The buccal nerve gives off close to the buccal ganglion the secondary pharyngeal nerve which branches into two nerves close to its origin.




Text-fig. 13.—Nervous system of *Rachisellus punctatus.* The pedal nerves are shown in a separate figure. a. n. anal nerve; a. g. n. anterior gastric nerve; b. g. buccal ganglion; b. n. buccal nerve; c. c. n. cephalo-cutaneous nerve; c. g. cerebral ganglion; e. l. n. external labial nerve; i. l. n. internal labial nerve; int. n. intestinal nerve; l. p. left pleural ganglion; o. n. optic nerve; pa. n. pallial nerve. pe. n. penial nerve; ph. n. pharyngeal nerve; pl. pleural ganglion; p. cut. cutaneo-pallial nerve; p. t. n. peritentacular nerve; pe. n. penial nerve; r. p. right parietal ganglion: st. n. nerve of the statocyst; t. g. tentacular ganglion; t. n. anterior tentacular nerve; v. g. visceral ganglion.




Text-fig. 14.—The pedal ganglion and the pedal nerves; p. g. pedal ganglion; st. c. statocyst.

Besides these nerves each cerebral ganglion gives off posteriorly a slender nerve to the statocyst and the right one gives off a short nerve to the penis. The nerve to the statocyst runs between the cerebro-pedal and cerebro-pleural connectives.

The cerebro-pleural and cerebro-pedal connectives are thick and separate. The visceral ganglion is oval and gives rise to three long nerves. One of them, the anal nerve, passes through the columellar muscle to the anal region of the mantle, accompanying the pallial artery for a part of its course. The second, the intestinal nerve, proceeds towards the posterior region of the spermoviduct near its origin from the albumen gland, and runs to the intestine. The third nerve passes under the columellar muscle and goes to the ventral part of the mantle. This is the cutaneo-palleal nerve. The right parietal ganglion is oval in shape and larger than the left, which is round. Each parietal ganglion gives off a long pallial nerve. The pleural ganglia are round in shape, and I have not seen any nerves arising from them.

The pedal ganglia are oval with their broad ends in front and are connected by a very short commissure. Each pedal ganglion gives off eight chief nerves, two from the posterior end, two from the anterior end and four from the lateral aspect. Of the two posterior pedal nerves one is dorsal and the other is ventral. The two dorsal pedal nerves of the foot lie more or less parallel to each other and run to the posterior end of the foot. Two long slender nerves arise from each nerve and run to the more ventral of the muscles of the foot. The postero-ventral nerve arises ventral to the postero-dorsal and passes down into the foot. The anterior pedal nerves are also dorsal and ventral. The dorsal nerves arise from the anterior edge, close to the upper surface of the pedal ganglia, and running forwards, divide into two branches each, one dorsal and one ventral. The antero-ventral pedal nerves arise from the ventral surface of the pedal ganglia and pass forward to the ventral muscles of the foot. The lateral nerves run to the dorsal and the ventral parts of the sides of the foot.

The statocyst lies on the dorsal surface of the pedal ganglion, nearer to the outer surface, and is innervated from the cerebral ganglion by a slender nerve.

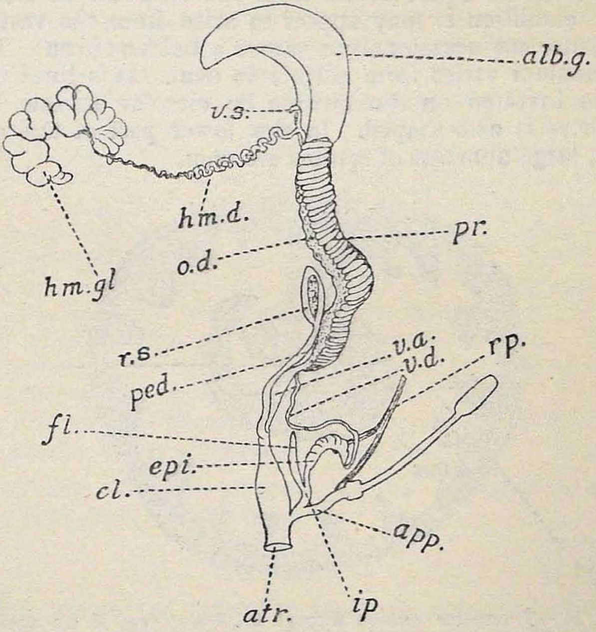
*The Reproductive System.*

The hermaphrodite gland is situated on the columellar side of the first and the second whorls and extends for a length of about 2 mm. It consists usually of five, more or less distinct lobes of oval acini. The number of acini in the different lobes varies. In one specimen the number of acini were as follows: I–5, II–4, III–3, IV–5, V–4.

The hermaphrodite duct is about 3 mm. long and convoluted, showing about 20 to 25 coils. The lower, or proximal part which is thicker, is more closely coiled than the upper, or distal part.

The duct reaches the albumen gland about a millimetre from its lower end. The vesicula seminalis ("poche de fecondation") is small and bent at its free end like a hook. It appears as though it were formed by the hermaphrodite duct getting doubled on itself on one side before reaching the albumen gland.

The albumen gland measures about 6 mm. in length and about 2 mm. in thickness. It is elongate and lingulate. In young specimens the gland consists of tubules of large oval cells with prominent, basally placed oval nuclei and with cytoplasm showing large spherical granules which stain deep. The spermoviduct is about 8 mm. long and has a puckered appearance. In very young specimens it is in the form of a slender tube, and as the animal grows to maturity, the walls become glandular and thick. A transverse section through the lower part of the spermoviduct is often roughly oval to semi-circular in outline and invested on the outside by circular and longitudinal muscle fibres, while the inside is lined by rather cubical cells with large, round nuclei. The epithelium lining the



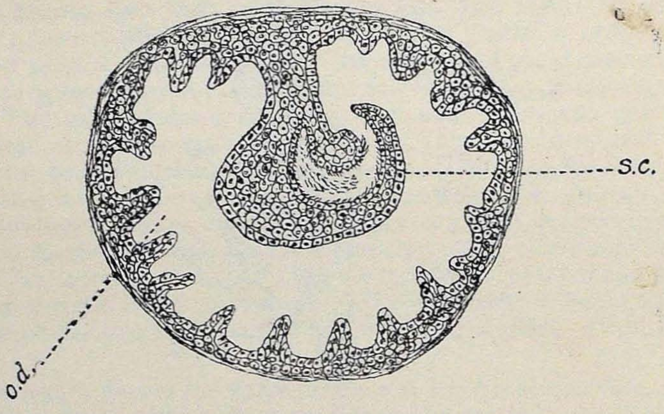

Text-fig. 15.—Genitalia of *Rachisellus punctatus*. alb. g. albumen gland; app. penial appendage; atr. genital atrium; cl. cloaca; epi. epiphallus; fl. flagellum; hm. gl. hermaphrodite gland; hm. d. hermaphodite duct; i.p. inner branch of the penis; o.d. oviduct; pr. prostate; ped. peduncle of the receptaculum seminis; rp. penial retractor; r. s. receptaculum seminis; v. a. vagina; v. d. vas deferens; vs. vesicula seminalis.

cavity is thrown into a number of small irregular villi-like folds, in the central part of which, as well as towards their immediate outside, a large number of gland cells are present. In longitudinal section the gland cells appear oval in outline with basally placed nuclei and cytoplasm staining pink. On one side of the spermoviduct, the cubical epithelium projects into the cavity of the duct as a roughly crescentic fold directed to one side and a similar but smaller projection arises from the neck of the latter. These two folds bound the seminal canal, and as they do not unite, but leave a narrow passage between them, the seminal canal is incompletely separated from the rest of the spermoviduct which consti-

tutes the oviduct. The cells lining the seminal canal show cilia at their free ends. In some of the sections large numbers of sperms were noticed in the seminal canal.

The prostate is well developed and overlies the spermoviduct for a length of nearly 6 mm. It has a ribbon-like appearance showing transverse bands. It is lined by oval gland cells with homogeneous cytoplasm and with basally placed round nuclei. Between the distal ends of these gland cells, narrow cells with oval nuclei can be made out.

The receptaculum seminis lies against the lower part of the spermoviduct, and inclusive of the peduncle measures 4 mm., the receptaculum alone measuring about 1·5 mm. The peduncle joins the spermoviduct about a millimetre from the vestibule or cloaca. In the contracted condition it may appear to arise from the vestibule. It is usually tubular but occasionally assumes a bulbous form. The shape of the receptaculum varies from elliptic to oval. It is lined by columnar cells and is invested on the outside by circular muscle fibres. The spermatophore is club-shaped. In the lower part of the spermatheca, sometimes, large numbers of sperms are seen.




Text-fig. 16.—Transverse section through the lower part of the spermoviduct ; sc. seminal canal with sperms ; od. oviduct.

The vas deferens arises from the spermoviduct, a little in front of the spermatheca and measures about 4 mm. in length. The cloaca is about 4 mm. long, roughly oblong in outline and blackish brown in colour. It opens on the right side of the head as described already. About ·75 mm. from its external opening, the vestibule receives the opening of the penis. This part of the reproductive system differs from that of *Ena*. Gude (3) quotes Lehmann's description of the lower part of the reproductive system of *Ena* as follows: " The penis is of peculiar shape, its lower portion being attenuated towards the cloaca and becoming dilated distally; the latter short portion divides into two branches, the one proceeding upwards at a right angle, when it suddenly becomes twisted, forming another right angle, continues in a horizontal direction, terminating in a rounded bulb. The latter receives the vas deferens. The rather long retractor muscle is attached to the lower part of the vertical portion.

The other branch at first proceeds in the same direction, then curves upwards at an obtuse angle, decreasing in size and becoming filiform, undulating, and terminating in a curved, thin, long and club-shaped flagellum". The vagina in *Ena* is said to be as long as the uterus.

In *Rachisellus* the penis is very short and shows no attenuation towards the cloacal region. It divides into two parts, one of which is outer and forms the penial appendage. Three parts can be made out in the penial appendage, a stout, proximal, or lower part, often exhibiting a collar-like appearance owing to partial retraction, a narrow tubular part and a distal, oval, flask-shaped, or sometimes, even oblong terminal part. The other inner branch of the penis proceeds upwards and divides into the flagellum and the "epiphallus" which receives the vasdeferens. The relation of the epiphallus to the flagellum varies to a certain extent. In some specimens the two were observed to arise together from the inner branch of the penis, while in a few the epiphallus appeared to arise from the lower part of the flagellum. This is probably due to a partial retraction of the flagellum. The epiphallus is roughly crescentic in outline and its convex surface shows transverse ridges. One branch of the penial retractor is attached to the middle of the concave or lower surface of the 'epiphallus', while the other is attached to the penial appendage below the collar-like portion. The flagellum is simple, short and tubular and does not show any filiform undulating or club-shaped structure, as is observed to be the case in *Ena*. The wall of the cloaca, as already indicated, is blackish brown in colour. The cloaca is lined on the inside by short cells and the wall is made of irregularly round cells with very thick and well defined cell limits. The cells are vacuolated and show little cytoplasm, and the nuclei are situated near the cell limits. Muscle fibres are seen between the cells.

It will be seen from this account that the reproductive system of *Rachisellus* differs from that of *Ena*.

### *Conclusion.*

*Rachisellus* shows the typical features characteristic of *Enidae* in the presence of (1) a well developed ribbon-like prostate, (2) a well developed receptaculum seminis with a long peduncle, (3) a flagellum, an epiphallus and a long penial appendage in the male part of the reproductive system, (4) a double penial retractor (5) and in the general structure of the radula.

It deviates from the typical *Enidae* (1) in the absence of "coulsde-sac" of the hermaphrodite duct, a feature which is said to be characteristic of *Enidae*, (2) in the absence of a diverticulum of the receptaculum seminis, which is present in many specimens of *Enidae* (3) and in the complete reduction of the lateral cusps of the central tooth of the radula. This tendency is, however, seen in the family as a whole. In the first two features *Rachisellus* resembles *Pachnodus*, which, however, has a different radular structure.

As pointed already, the systematic position of *Rachisellus* has undergone changes more than once. For sometime it was relegated to

the synonymy of *Rachis*. Owing to its radular resemblances, it was made a sub-genus of *Ena*. "The Achatinoid aspect" of its shell was considered by Gude (3) a sufficient case for retaining it as a separate genus. The study of the anatomy has shown that the resemblance to *Ena* is only general and not sufficient to warrant its being made a sub-genus of *Ena*. The central tooth of *Rachisellus* differing only slightly in size from the laterals, and having a trapezoid basal plate, the presence of an epiphallus, besides a flagellum and a penial appendage in the reproductive system, and the relative lengths of the 'uterus' and the 'vagina' are important features distinguishing *Rachisellus* from *Ena*.

In conclusion I have to express my best thanks to Dr. Baini Prashad for some of the references, to Dr. H. S. Rao for the verification of the species and references and to Dr. Steenberg of Copenhagen for sending me some of his papers.

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# Kerala Theatre

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That little tract of land in the south-west corner of India which lies snug and secure in the fond embrace of the mighty arms of the *Malaya Parvata* on the one side and the *Paścima Pāridhi* on the other, is a unique little area, probably the most self-centred, self-contained in the whole range of this vast peninsula. The creation and the colonisation of this area are, according to local tradition, ascribed to that great Brahmin warrior and inveterate hater of monarchy, Sri Paraśurāma. This tradition, when subjected to a historical scrutiny, can mean only that it was this intrepid warrior who discovered Kerala to the Aryans and introduced into it the Aryan culture and civilisation; and quite consistent with this, our local traditions make him the sole organiser of our *grāmāms*,[1] the primeval founder of our temples, the great systematiser of our rituals, *Vedic* and *Tāntric* and *Māntric*, and the earliest architect of our social, religious, and political *Dharma*. The beginnings of the Aryanisation of our culture may go back to a hoary antiquity. True, indeed, we cannot trace its first beginnings and subsequent developments from that remote, dim, shadowy past, through the vast sweep of centuries, but available records and traditions show that, since the dawn of the Christian Era, our culture and civilisation never underwent any convulsions violent enough to bring about any complete metamorphosis. Thanks to her isolated situation and the abundant security that a benign nature conferred upon her, she was never a prey to the ruthless foreign invader, who in the words of the late lamented Prof. Sir William Ridgeway, 'wherever they went changed the aspects of the lands they conquered and into which they introduced their own laws and customs and manners!' Such is the case elsewhere in India, and especially is it so in Northern India. This does not mean, however, that Kerala was enjoying an isolated seclusion. Even at the earliest period of which we have any record—and this is pre-Christian in point of time—our fore-fathers were carrying on a very brisk trade with various countries far and near, and the modern Cranganore figures under various names as the greatest emporium of trade in the whole east, in whose spacious harbour could be seen the ships of the Phoenicians, the Egyptians, the Grecians and the Romans from the remote west, and the Malays, the Chinese and the Papuans from the Far East. But all these came not as invaders, but as peaceful traders, and consequently, while everywhere else foreign influence led to culture suppression and culture transformation, in Kerala this led only to culture stratification and culture assimilation. Naturally therefore that vigorous seedling of Aryan culture that was successfully transplanted into the indigenous culture-soil continued to flourish there in all its vigour and vitality and to live and grow into a beautiful tree with brilliant foliage and yielding

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[1] A *grāmam* means a social and religious unit. It is not to be confused with a village. The whole Kerala is divided into sixty-four *grāmāms*.

sweet fruits. Kerala can, therefore, boast for her culture a continuity that is scarcely less interesting than her antiquity. And when it is remembered that this culture was constantly brought into contact with a number of distinct and different cultures, one can naturally expect to find here cultural assimilation and cultural superimposition, resulting in a new synthesis of conflicting civilisations. These three facts—antiquity, continuity and culture-synthesis—lend to the study of this culture more than a passing interest and importance. Add to this also the existence of a large number of 'genuine primitive survivals' in almost every aspect of our social, religious and political life and one may without exaggeration assert that our cultural antiquities open up a field of inquiry at once interesting and important not merely to a particular section of scientific students but to all alike—to the student of archæology and anthropology, to the student of art and architecture, to the student of religion and philosophy.

One aspect in which this wide and varied culture has found expression is the subject of the present study—I mean the stage. The Kerala Stage has made its own valuable contribution to the sum of Indian culture. The orthodox section of this stage which has a religious atmosphere attached to it and is, therefore, beyond the gaze of profane eyes, plays no inconsiderable role in helping the reconstruction of the ancient Sanskrit stage,—the active traditions of which have died out elsewhere in India—and in assisting the elucidation of one of the outstanding problems of Sanskrit Literature of the day—I mean the well-known Bhasa problem which has been generally misunderstood on account of the dearth of information regarding our stage practice. No less important is the vernacular section in which beginnings may be found revealed of the art of dramatic representation, beginnings probably primitive in character, but none the less interesting for that. Besides, the development of the stage raised the local spoken dialect to the status of a literary language. And the two together present to us a complete picture of our national tastes and cultural temperaments. It would be proper to mention here that the term stage or theatre is used in a very wide sense as embracing within it all kinds of spectacular entertainments which are characterised by the appearance in public of one or more persons in costume for the purpose of entertaining the audience and which have some literature connected with it.

## II. INTRODUCTION

(*a*) *General Features.*—In the sense in which the term stage or theatre is here understood, its most outstanding characteristic seems to be the wealth and variety of its forms. The aim of all spectacular, or more correctly, dramatic entertainments is mainly two-fold: to impart instruction and to afford pleasure. The theatre is possibly the surest and certainly the most obvious way of educating the masses. It is again a very powerful instrument of social reform and, no doubt, in olden days it discharged this function as satisfactorily as the press and the platform do in modern days. Besides, in those times the propagation and popularisation of religion constituted one of the main functions of the theatre. And lastly it provides inexhaustible source of delight. According then

as the object of the dramatist differs, so does the nature of the play. Didactic plays are generally careful of their story, and this, so far as we now can say, has been true of all Sanskrit dramas. Those intended to reform society teem with wit and humour. Religious plays are either allegorical or clothed in an atmosphere of super-naturalism. Proper acting with due regard to naturalness of representation, and dress, music and scenic effect can be met with only in such dramatic works as have pleasure for their main aim. This variety of aims accounts to no little extent for the variety in our spectacular entertainments. We have thus entertainments which have predominantly an educative value, a religious value or an æsthetic value. Thus the Sanskrit section of our theatre has served most effectively to popularise the Hindu religion and philosophy, and with it the language in which they have found expression. It also developed a keen sense of literary appreciation and produced a number of literary works and commentaries which, both in quality and quantity occupy a high position in Sanskrit Letters. Similarly, the vernacular section has by its contribution developed a spoken dialect into a literary language. And it is not too much to say that our stage has got its eloquent appeal to make to the students of literature, both Sanskrit and Malayalam. And furthermore, it can claim an unbroken continuity through the vast sweep of at least a thousand years. On account then of these facts, our theatre becomes an important source of study to all those who aspire to a knowledge of our ancient culture.

Another feature of the Kerala theatre, probably the most outstanding one, which to a great extent distinguishes it from the Tamil, the Telugu, the Kannada or the English stage, as now known, is the prominence it assigns to actual acting and dancing. Such terms as *Nāṭaka Nātya* lend weight and authoritativeness to this practice of our stage; for these are suggestive enough of the place that has to be assigned to acting in the presentation of a Sanskrit drama, which is as it were the well-spring of all our indigenous types of vernacular entertainments. The venerable sage Bharata may also be mentioned in this connection in view of the fact that he devotes a large section of his work to the scientific exposition of the art of acting. It is not an exaggeration to say that the numerous dancing postures described by him can find living examples in the wonderfully artistic poses constantly exhibited even to-day by Kerala actors. In view of this, in according to acting and dancing their proper pre-eminence, our theatre is but keeping truer and nearer to the ideals of the ancient Hindu stage tradition.

The third equally important and prominent feature of our theatre is the use, almost exclusive use, of the gesture language of a highly codified and systematised character. This is so prominent a feature that in some varieties this, and not any spoken language, is the only means of expression. The codified gestures which are used as a means of conveying ideas in the various types of entertainments may well be classified under the three heads of: (1) *Natural Gestures*, such as are unconsciously produced and utilised, when the speaker is moved by great emotion or passion; under this head may be included such gestures as those used for denoting *come, go, eat*, etc., (2) *Imitative Gestures* which reproduce the shape or some striking peculiarity of the thing or person or being;

such for instance as those referring to *lion, elephant, tiger, fish, tortoise,* etc. (3) *Gestures* resulting from the amplification for secular purposes of the orthodox types of *Tāntric and Māntric* symbols such as those used for *Ārādhana, Abhaya, Dāna, Āvāhana,* etc. The original ritualistic symbols must have been amplified for the use of the *Cākyārs* in staging Sanskrit Dramas, and thence it must have been extended to the secular varieties. These three varieties which consist of primitive instinctive gesticulations and natural and symbolic representations lend themselves to all sorts of permutations and combinations, and these, when combined and systematised, constitute the code of gesture language. (See Plate I: Some typical *Mudrās*).

It may here be mentioned that even the *Māntric* and *Tāntric* symbols must originally have been elaborated from the simple natural and imitative gestures. It is, therefore, not far fetched to assume that the *Tāntric* and *Māntric* symbols must have served as the basis of the gesture language of the stage, later developed by the addition of the imitative and instinctive gestures. And so far at least as the Sanskrit stage is concerned, this gesture language must have been introduced with a view to popularising the sacred language also. It appears, besides, to have served another practical purpose. An orthodox code requires that Brahmins should not use the profane vernacular during the course of their daily rituals; at the same time it is practically impossible for them to avoid communication with the *Ambalavāsis.*[1] Sanskrit could not serve this purpose and the *Nampūtiris* (Kerala Brahmins) might have developed a simple code of gesture-language.

Whatever might have been the motive, this device served as an excellent method for helping the illiterate crowd to understand the language of the play and appreciate it better. That this must have been the original motive is also clear from the fact that the code of gestures used by the *Cākyārs* is far simpler than that used by the actors of the *Kathakaḷi.* For, in the former the actor has to confine himself to the space between the elbows of his outspread arms, while for the latter the whole space between his extended reach is at his disposal. The larger space available makes the *Kathakaḷi* gestures more graceful and understandable probably so designed to make the code appeal even to the larger crowd of illiterate audiences. The use of gesture-language as a means of communication appears to be very old, older than even *Kūttu.* In its beginnings, the code must have been very simple and natural and hence easily understandable, and it later became codified and stereotyped as the actors' language. This is a subject that deserves to be studied in detail.

These then, namely, the abundance of variety, the prominence given to acting and the use of a codified gesture language constitute the peculiar features of our stage, both Sanskrit and Vernacular.

(*b*) *Classification.*—Almost all the varieties of our spectacular entertainments are characterised by a religious atmosphere, in some cases intrinsic and in others extrinsic, which may be made the basis of

[1] The Ambalavasis constitute the intermediate caste between the Nampūtiris and the Nairs, and their main profession is temple work. The Cākyārs are Ambalavasis.

classification : thus we have the purely religious, the semi-religious and the secular types. Under the religious head may be mentioned (i) *Bhagavati pāṭṭu*, (ii) *Tiyyāṭṭu*, (iii) *Pāna*, (iv) *Pāṭṭu*, (v) *Kaṇiyār Kaḷi* and (vi) *Mutiyettu*. Under the purely secular variety may be mentioned (i) *Eḷāmuttipuṛappātu*, (ii) *Tuḷḷal*, (iii) *Koṛattiyāttam*, (iv) *Mohiniyāṭṭam*, (v) *Kayyukottikkaḷi*, (vi) *Pāthakam* and (vii) *Kathakaḷi*. Under the religious head may be placed (i) *Sanghakkaḷi*, (ii) *Kūttu* and (iii) *Kṛṣṇāṭṭam*.

Such a classification holds good so far as the language also is concerned : the first two varieties are purely in the local vernacular, while the last, I mean the semi-religious variety, is mainly Sanskrit. They are also capable of a classification from the prominence of one or other of the elements of acting, dancing and music. In *Kathakaḷi* and *Kūttu* proper acting occupies the most important place ; in *Korattiyāṭṭam* and *Mohiniyāṭṭam* dancing takes the place of importance, while in *Kayyukottikkaḷi* we have practically only vocal music and a very simple kind of dance.

(c) *Conditions of Staging.*—Restrictions imposed upon the actors or acting are very few indeed, except in the case of *Kūttu* and *Kṛṣṇāṭṭam*, and all of them dispense with the necessity for an elaborate stage. Any open space with a small temporary shed used to serve as a stage, and a coloured piece of cloth to serve as a curtain constitute the essential stage accessories. Lighting effect is never attended to, and, as a general rule, there will be but a single big brass lamp, about three feet high with wicks placed on either side. It is also not allowed to spice the representation with any sort of instrumental music. All the music available is what is produced on *Asura Vādyas* and what is supplied by the vocal music of the actors or the singers themselves. The absolutely primitive nature of the accompaniments and the accessories is a sure indication of the necessarily great share of work that the actors themselves have to discharge to win popular appreciation and approval ; and it is no small credit to their superb acting that many of these varieties do cater even today to the recreation and pleasure not merely of the rustic crowd but also of the enlightened.

## III. RELIGIOUS VARIETY

The six varieties of *Bhagavati Pāṭṭu*, *Tiyyāṭṭu*, *Pāna*, *Pāṭṭu*, *Kāṇiyar Kaḷi*, and *Muṭiyettu* have been characterised as religious, for the simple reason that they are invariably found celebrated in Bhagavati shrines in honour of the goddess, sometimes as an annual festival conducted by the temple itself and at other times as a votive offering by the pious villagers in the temple or in their homes. These are intended to glorify the Bhagavati cult and deal exclusively with the glorification and thus the popularisation of that cult which, by the way, is one of the theistic Hindu cults most popular in our parts. They have again for their main theme the destruction of *Dārika* by *Kāḷi* or the Victory of Pārvati over Śiva. The language of these songs is exclusively in the local vernacular, and the actors or the dancers are generally from the lower orders of the caste Hindus. These and the fact that the lower types of *Tāntric* and *Māntric* rituals are also found associated with some Bhagavati shrines tempt one to think that in these spectacular representations

may be found the sole surviving relics of the old type of the worship of sylvan Gods and Goddesses current amongst the indigenous native population which by culture-contact and culture-stratification were purified, ennobled and admitted into the Aryan fold.

### (i) Bhagavati Pāṭṭu

*Bhagavati Pāṭṭu* is generally found conducted either in temples or in the houses of the Kerala Brahmins, called *Nampūtiris*. The figure of Bhagavati with heads and arms and body is drawn on the floor with colured flour and then *Jīvapratiṣṭha* is done. Sitting around it and playing upon some of the musical instruments the troupe of people, called *Kurups*, sing the songs glorifying the goddess. The songs continue and the story reaches the climax, when the *Komaram* [1] attached to the temple becomes possessed and begins his weird dance carrying a jingling *cilambu* in one arm and a pointed sword in the other. He explains in human accents the ideas of the Goddess, as it were, and points out how the Goddess—he uses the first person—is great and good and powerful, how she is pleased with the devotion that the people have shown but how they have failed in this one or that other respect, how she is well pleased with them with the conduct of the *Pāṭṭu* and how she will always protect them. As the process of talking goes on, the songs continue and the musical instruments go on sounding. In due course the *Komaram* quiets down and the whole function comes to a close.

### (ii) Tiyyāṭṭu

*Tiyyāṭṭu* is similar to the above in all respects except for this difference: that when the songs reach the fifth stage the *Komaram* in his possessed fury jumps into the fire and executes some weird stepping dance. While the former type of dance can be either a family or a votive offering, this latter is always a village or a communal offering. The most important point in this so far as we are now concerned is the presence of music, to the accompaniment of which there is a sort of dancing by a character who poses as a representative of a divine being for the edification of a large audience in an open place.

### (iii) Pāna

*Pāna* is another variety of similar dancing, and though not much different from the preceding, it is technically held to be different. Two types are prevalent: it may be an individual votive offering, in which case there is only one *Komaram* taking part in it—the *Komaram* associated with the temple in which the performance is conducted. It might also be a communal or a village function ; in which case all the *Komarams* of all the Bhagavati shrines in the neighbourhood must take part in it. Dressed in their usual weird habit, they conduct in unison a very queer kind of dance to the accompaniment of the instrumental music of the

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[1] Komaram, also known as Veliccapāṭu, is the earthly representative of the Goddess. He is selected from amongst the Nairs generally.

type called *Asuravādyas.*[1] As a third sub-variety of the same, may be mentioned another similar dance in front of a Bhagavati shrine conducted by *Kaṭupoṭṭans*, a class of people included amongst the lower orders of Nairs, who become possessed under the influence of alcoholic drink. This *Paiśācika* variety, be it noted, is run as a village offering for the purpose of getting rain, when it is inordinately delayed—an evidently powerful clue as regards the Dravidian origin of these and other similar types of entertainments conducted in the name of Bhagavati.

## (iv) Pāṭṭu

Not far removed from these in essentials, much less in spirit, is the variety, known as *Pāṭṭu*. It is purely a family or domestic function celebrated by rich families as a beneficent complement to such a ritual as marriage. The purely religious aspect of this consists in the invocation of the Goddess *Pārvatī* on a properly, I mean tantrically, made seat, i.e. a *Pīṭha* surrounded by the various items of *Mangalā-Caraṇa*; this is then followed by the singing of songs by a particular set of *Ambalavasi* women, called *Puṣpṇis*, in a sing-song tone accompanied by the sounding of a metal plate with a table knife. At the same time there stands in front of the goddess invoked a couple of ladies dressed in their religious ceremonial dress, and as the song proceeds, they become possessed and then begin a circular dance and convey the commands of the Goddess. The function begins early in the morning and with necessary intervals runs on the whole day and night. Here again we have the glorification of the Goddess, but it differs from the other kinds in that here it is a woman who becomes possessed.

## (v) Kaṇiyār Kaḷi

*Kaṇiyār Kaḷi* is another variety of interesting performance current in the northern parts of Cochin, conducted in Bhagavati shrines. When the performance comes on, there is erected a decorated *pandal* in the temple adorned with flags and festoons. In the centre a big lighted lamp is placed, round which the players dance to set music, both instrumental and vocal, the dance being supposed to be an imitation of the dance of *Mahākāḷi* and *Mahākāla*. The performance generally continues for three days, the portion for each day being fixed with reference to the music. On the first day we have the *Āṇdikūttu*; the second day we have the *Vaḷḷuvon Pāṭṭu* and on the third, the *Malama Pāṭṭu*. *Āndikuttu* means acting in praise of *Āndavar*, i.e., Subramanya, the issue of Siva. *Vaḷḷuvon Pāṭṭu* is in praise of *Vaḷḷuvon* who is held to have been a saint and philosopher, and *Malama Pāṭṭu* was so called, because probably a mountain song was sung. All these songs are highly devotional in sentiment, though here and there may be found references to social incidents. The main performance is done in the temporary hall and each day has its fixed songs. After the songs and dances are over, some farcical element is introduced in which the various castes are

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[1] Asuravādya is the name given to the instruments such as *Ceṇḍa*, *Kombu*, *Kuḷal*, etc. and the music produced by them is loud and is everything that is the opposite of gentle.

represented and ridiculed for their various vices. This portion of the representation is called by the name of *Porāṭṭu*, and its main theme is humour and social satire, each player appearing in costume suitable to the character. On the final day after the songs are over, all the players together worship the Goddess enshrined in the temple and make their exit. This is again a queer kind of performance in which music, vocal and instrumental, and dancing and acting play an equally important part: but as in the varieties considered, here also the main and central point of interest is the Bhagavati, enshrined in the temple. Naturally therefore this also deals with the glorification of the Bhagavati cult. This is, however, like the *Pāna*, a group or communal celebration, where all males, children and adults, can take part, and is celebrated both as a votive offering and as a temple function.

### (vi) Muṭiyettu

Unlike the varieties hitherto described stands *Muṭiyeitu*, which is the most important of the representations associated with the Bhagavati Cult. This is the only variety in which two characters appear in costume, the one representing *Kāḷi* and the other *Dārika*. The term itself is significant in that it means the *Yettal* (wearing) of the *Muṭi* (the crown) of *Kāḷi*. A critical study of these various religious varieties tempts one to associate the origins of dramatic representation with religious music accompanied by spontaneous gestures and then music with dancing. Since the figure drawn combines in itself both pictorial and sculptorial representation herein may also be seen the beginnings of painting and sculpture. This then forms an important variety which deserves to be more closely studied.

As before this again is celebrated in Bhagavati temples and is conducted by a subsection of Ambalavasis, called Kurups, who combine in themselves the arts of music and painting, acting and dancing. They arrive early in the afternoon, and in a conspicuous place in the temple front prepare a relief-painting of the Goddess *Kāḷi* in her most terrific aspect. Simultaneously with the evening rites in the temple, they begin to entertain the people with their music, vocal and instrumental. When the evening rites and ceremonies of the temple are over, the idol of the goddess is taken out in procession and after a fixed number of circum-ambulations in the precincts of the temple it is kept in a prominent place. The first item in the representation is a meeting between Śiva and Nārada, when the latter informs him that the earth is groaning under the oppression of *Dārika* and it closes with Siva's promise of his destruction by *Kāḷi*. In the meanwhile the two characters who impersonate *Kāḷi* and *Dārika* and are dressed in costume are ready to appear and at the appointed hour *Dārika* comes out and challenges *Kāḷi*. The challenge is accepted, and *Kāḷi* rushes in. There is no fixed stage—the whole temple area forms the stage and the characters walk about in a moving fight. Here is a long, tedious process of acting a battle between the two, and ultimately the goddess wins killing *Dārika*. The last act is an imposing scene and fills the audience with terror, occurring as it does at day-break. The chief item of the murder scene is

when *Kāḷi* plunges her hands into the very bowels of *Dārika* followed by the drinking of and besmearing the body with blood, and ultimately she adorns herself with his intestines.[1]

The success of the acting depends, as it necessarily must, on the superior practical skill of the actors in the matter of acting, all the more so since there is no other serious accompaniment to relieve the tedium. This representation is looked upon as a very orthodox and religious act, and so it is beyond the pale of popular criticism from the point of view of aesthetics, and one must necessarily concede that this acting is of a superior order. The costume of the characters agrees in many respects with the costume of the characters in *Kathakaḷi*, and without committing oneself to rash statements, one may suggest that the latter may have been derived from the model of the former. Further, I incline to find in this religious representation one of the few surviving relics of the indigenous type of spectacular entertainments, and this more than anything else has tended to popularise the Bhagavati cult in Kerala.

## (vii) Conclusion

The purely religious variety may be better termed the *Bhagavti Cult* variety, because in all these the glorification of the Bhagavathi is the main object. It has also been mentioned that in many of these varieties, the *Komaram* plays a very important part. He is a personage connected with almost all important Bhagavati shrines in our parts. His other name is *Veliccapāṭu*, and he is looked upon as the earthly representative of the Goddess and when he is ' possessed ', he is generally accorded all the honours given to the deity herself. When we remember how *Komarams* used to be selected, as they are even at the present day, we may truly see in the same, a process more or less similar to what has been described by Sheppard in his Greek Tragedy: ' Since the worshipper is regarded as affecting a God by his prayer, he assumes the character of the God to influence him and he conceives the God assuming the character of the worshipper in order to be more easily influenced '. The *Komaram* identifies himself with the Goddess and thus becomes ' in fact by enthusiasm literally filled with the Goddess '. Herein is found in short a very crude kind of Goddess impersonation on the part of the worshipper. Again, as in Greece, the performance is always out of doors, the actors, musicians and the spectators all being in open air. The performance is conducted by day in some varieties, while many of them are held during night, sometimes lit up by the moonlight but always by lamps and torches. Further, the main centre of interest is not so much the representation, as the Bhagavati shrine or the figure drawn of the Goddess in relief-painting in some prominent place. Furthermore, there is absolutely no effort made at any scenic effect, while the place and time are denoted by mere words or proper gestures. Thus it will be seen that Bhagavati cult dances, music and acting are entirely a religious function and a religious act, with the requisite religious solemnity pervading the whole performance, but with this difference, namely that

[1] There is kept within the costume a pouch containing some red liquid and a long unseemly chain-like thing to represent the intestines.

the audience is bent upon enjoying it. It is also interesting to point out that the songs, the dances and rude pantomime acting—all these are hung on to a tragic story, the destruction of *Dārika* by *Kāḷi*. There are some interesting parallels with the Grecian representation during pan-Athenæic festivals. Thus there is the simple act of worship, broadening into a drama. There is also the process of the humanisation of Gods. And last, but not least, comes the mythological nature of the subject which hangs on to a tragic story and which has special reference to national cults and cult-acts. An intensive study of these from a comparative point of view is sure to yield some useful results which may throw some more light on the problem of the origin of theatrical representations.

In *Kāḷi's* destruction of *Dārika* one is tempted to find not a nature or vegetation myth. I am inclined to associate it with Hero-worship—worshipping the hero or heroine who rescued the place from the oppression of a wicked demon. When, however, it is remembered that *Kāḷi* fights her battle with sword and shield and *Dārika* with sticks, it is tempting enough to search for in this the pre-historic clash between the earlier wood age and the later iron age. But this topic does not come within the province of the present subject, and I do not wish to pursue it further, except to suggest that a detailed, systematic study of the same may also help to elucidate the pre-historic culture-values of the Malayalis.

## IV. SECULAR VARIETY

The importance of this variety cannot be over-estimated for its contributive value to the enrichment of Malayalam and Sanskrit Literatures. The development and popularisation of the varied types of secular entertainment have definitely contributed to the growth of Malayalam Literature and to its elevation to the status of a literary language. The more important of the types under this head are (i) *Eḻāmutti-purappāṭu*, (ii) *Tuḷḷal*, (iii) *Korattiyāṭṭam*, (iv) *Mohiniyāṭṭam*, (v) *Kayyukoṭṭikkaḷi*, (vi) *Pāṭhakam* and (vii) *Kathakaḷi*, which represent between them all varieties of singing, dancing, and acting with the appearance in public of characters in costume. As in the case of the purely religious type there is no fixed stage, but unlike it there is always a curtain used; again unlike it, the centre of interest is the actual representation in front and not the temple or the figure of a Goddess (*vide* section III-viii). In the case of one at least of these varieties, the method of announcing the performance is singularly effective. The instrumental musician, the *Ceṇḍakkāran* sounds in the evening his instrument in a peculiar manner called *Keḷikoṭṭu*. This sound is generally heard within a radius of not less than two miles. Equally effective from the practical point of view is the method of advertisement. When a troupe of players come to a village they hold a free performance, called *Sevakaḷi*, in the village temple. This serves the double function of paying homage to the village deity and acting as a sort of advertisement, it being a common measure of encouragement given by the authorities of the temple to supply free light for the performance. A more effective way of announcing a troupe of players cannot be conceived. It deserves to be pointed out even

at the very outset that all these performances, including those already mentioned and hereafter to be mentioned, are free to all, i.e., there is no ticket system, and this is something in which our stage stands entirely apart from all other modern stages as far as we know. For the benefit of the village the richer people of the *grāmam* one after another invite the troupe to play in their houses, the expenses being paid by the inviter. A voluntary subscription is sometimes sought from landlords and other big men of the village at the spot in the course of the performance, and this is known as *Poli*, i.e., voluntary gift. Here, in this act, the rich villager discharges his part of the *noblesse-oblige* in the matter of intellectual recreation, as much as he does in the matter of supplying free education to the more unfortunate children of the village.

### (i) Eḻāmutti-Purappāṭu

Not the least important and perhaps the most interesting from a historical point of view is what is known as *Eḻāmutti-Purappāṭu.* This is a constant source of entertainment conducted in the houses of *Ambalavāsis* generally on the occasion of certain religious domestic ceremonies. This is one condition as regards the place of acting; the only other condition attached to it is that only *Ambalavāsis* and *Nampūtiris* are allowed to take part in the performance. The nature of the performance is as follows:—A number of people, and generally each of them is a good actor in some particular character, sit round a lighted lamp after dinner. Some sort of musical instrument is sounded and one from amongst the party sings a song which is a riddle and asks another member to answer the riddle. If the person questioned fails to answer, the questioner asks him to act the part of any character with or without proper costume. Immediately he begins to act what he has been ordered. When this is over, the procedure is repeated and the part that the player is called upon to act varies from that of a drunkard to that of the love-sick Rāvaṇa pleading to Sīta, care being always taken to see that each person is called upon to play only that character which he can act almost to perfection. This is a very simple form of domestic entertainment more of the nature of a farce and must no doubt have been a very interesting source of recreation.[1]

The name of the variety is interesting. No woman has a place in the actual conduct of the performance, though any one of the players may well impersonate any woman character; yet the term literally means *the appearance of seven maids*, or *hags*, to be more literal. One is almost tempted to remember in this connection the *Sapta Kanyakas* associated with Śaivite shrines on the East coast and the "Seven Vestal Virgins of Rome". This latter part becomes historically interesting, when it is realised that the Romans had one of their colonies at the Muziris of old i.e., the modern Cranganore. But the absence of a female actor stands in the way of tracing any connection between the two. Apparently one is forced to suggest a new interpretation of the term—to take the term as a debased form of "*Eḻāmūrti*"—seven characters, probably suggesting the original number of players

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[1] This is more or less similar to one form of the English game of 'Forfeits'.

taking part, or the impersonations to be staged. In the light of the information now available nothing further can be said about this.

### (ii) Tuḷḷal

No less interesting than *Eḷamutti-purappāṭū*, but more important from a literary point of view, is the variety called *Tuḷḷal*, one of the most popular sources of recreation amongst us. This is the result of a theatrical quarrel which has enriched our vernacular literature to a very great extent. Once while a *Cākyār* was acting a drama, the *Nambiar* was playing on the musical instrument of *Miḻāvu* (See Plate II-i) and he worked it wrongly. The *Cākyār* got angry and administered a severe reproof to him in the course of his dramatic exposition. This public censure was too much for the young *Nambiar*, and so, as soon as the performance was over, he sat devising a new mode of performance, and, working at it the whole night, produced something new in form and spirit, though it was based on a harmonious combination of *Prabandham Kūttu* and *Pāṭhakam*, which we shall refer to later on. He also devised a new costume which was more attractive than the costume of the *Cākyār*, but at the same time more ludicrous than serious. The next day, when the *Cākyār* began his *Kūttu*, his erstwhile assistant began his new performance with the required instrumental music. This attracted the whole of the *Cākyār's* audience. Such was the origin of *Tuḷḷal* ; and it retains even to-day the popularity that it had on the first day of its staging. This gifted actor-poet was the famous Kunjan Nambiar and he has made a very substantial contribution to the Malayalam Literature.

The scenic and musical equipment required in this variety of entertainment is comparatively little. The actor dresses in a costume that is peculiar, being distinct from the *Cākyār's* dress and the dress of the characters in *athakaḷi*. He wears a frilled skirt round his waist, with a couple of *bandha* round his arms. (See Plate II-ii) His face is painted and he wears a head-dress. There is, indeed, some difference in the costume for the different varieties of *Tuḷḷal*. The character is helped by a musician who leads the song and works on a *Madhaḷam* and another man keeps time to the song with a cymbal. The musician sings the songs which are then repeated by the actor to the accompaniment of acting and gestures and facial expression, while the instrumental music is kept up. In other words, the actor has to sing, act, gesticulate and at the same time dance—which involves some skill on the part of the actor. In this, then, may be found a harmonious combination of *Prabandham kūttu* and *Pāṭhakam*, while the use of the vernacular language, the absence of restrictions regarding place and persons acting, the presence of a character in costume, the accompaniment of instrumental and vocal music, these have made it more popular than *Kūttu* and more attractive than *Pāṭhakam*.

In addition, the gifted author of this innovation had 'a remarkable insight into the rationale of metrical effect and he therefore adopted various metres to match the variety of moods and emotions so that the spontaneity of impulse is at every turn exhibited by a suitable change in the measure, cadence and movement of the verse, and thus he leads

the way not merely in point of originality but in point of excellence in this branch of our literature.' Consequently, as he was the first, so is he the best of our *Tuḷḷal* poets.

As has already been mentioned, there are three varieties of *Tullal*, and they are known as *Oṭṭan Tuḷḷal*, *Parayan Tuḷḷal* and *Sītankan Tuḷḷal*. They differ more in the measure and cadence of language than in costume, except in the *Sītankan* where the actor adorns himself with ornaments made out of the tender leaves of the coconut tree. As has been suggested, the performances are generally in the form of ballads, sung in character. The Puranic stories supply an inexhaustible theme, but for the most part 'being fused with the colour and temper of the poet's mind' they appear as new creations. There are no curtains used and whenever the actor needs some rest, he has devised an easy method of taking it: he simply turns his back upon the audience. There is of course only one actor, and he appears generally with painted face and adorned with a head-dress which has some faint attempts at ornamentation generally in the form of a serpent hood. The actor has not merely to sing under the lead given by the singer, but he also acts, his whole body being set in motion: while his legs beat time to the song and music, he dances and his eyes and face express the sense of the songs and his arms represent the same in the code of the gesture language. Since the time of its origin, this has been a very popular type of entertainment.

## (iii) Korattiyāṭṭam

Another equally popular kind of dance representation is *Korattiyāṭṭam* or Gipsy Dance. The origin of this is not very well known and I am inclined to think that it is an importation, though it has been very well assimilated to our conditions of life. Two characters, appear on the scene in the garb of ladies, impersonating the wives of Śiva and Viṣṇu, accompanied by a musician who sings the songs to the accompaniment of instrumental music while the two characters act the songs in the language of the gesture code with the requisite facial expressions and dances (see Plate III-i). These two, the consorts of Viṣṇu and Śiva, carry on an interesting dialogue regarding the respective merits and demerits of Viṣṇu and Śiva, each trying to prove that her Consort is superior to the other's. They carry on the conversation by acting and dancing and by gesture language which is made clear by the musician who sings the songs, while an assistant keeps time on his cymbal.

## (iv) Mohiniyāṭṭam

*Mohiniyāṭṭam*, or the Siren dance, was once a very popular source of entertainment which has now practically died out. Here a lady appears in the garb of a temptress and entertains the audience with dance and music. The idea is based on the legendary story of Viṣṇu's appearing in the garb of Mohini to tempt Śiva. It is a very elegant type of recreation: but unfortunately because the women who thus appeared in public generally had low morals, it came to have some opprobrium attached to it; it is no longer a current entertainment.

### (v) Kayyukoṭṭikaḷ

The only other variety where women appear in public to entertain people is in what is known as *Kayyukoṭṭikaḷi*. Here a number of grown up ladies dance round in a circle (see Plate III-ii), singing the songs in chorus under their leader and keeping time with their hands; this resembles the Japi dance of the Mundas in Chota Nagpur but for the presence of the male who works the instrumental music.[1] The English educated ladies of the present day look down on this sort of entertainment and as a result this is also sharing the fate of *Mohiniyāṭṭam*. But fortunately there has been a revival, in that this is now being used as one of the methods of physical education for girls. This is important also from the literary point of view in that it has tended to create some good literature in Malayalam. This type seems to be on the border line between dance and drama. It is interesting to point out here that this particular type of folk dance is very common during the local *Tiruvātira* festival which is supposed to be a commemoration of the destruction of Kāma, Cupid, at the hands of Śiva. Can this circular dance be taken as an instance of the use of dances to honour the dead, as was the case at Athens?[2]

### (vi) Pāṭhakam

*Pāṭhakam* is bi-lingual variety, semi-Sanskrit, semi-Malayalam. In form and in nature, it is closely modelled on that variety of *Kūttu* which is called *Prabandham Kūttu*, and is probably connected with it in origin also. It consists in a dramatic exposition of any incident from the Puranas, the exposition being entirely in vernacular, while the verses for recital are in Sanskrit. It entirely dispenses with any kind of stage equipment, and there are no conventions to be satisfied, except probably the presence of a lighted lamp to be kept in front of the actor. On account of its simplicity of staging, it is one of the most popular types of entertainment current in our parts.

As the term itself suggests, the actor or expositor must be very learned and must besides possess a witty tongue and shrewd powers of observation; these, in addition to a melodious voice constitute an ideal actor. The costume of the actor is very simple, though quaint. He wears a head-dress which has some faint attempts at ornamentation, though in the absence of this, any coloured piece of cloth round his head will quite suffice. His chest is generally bare, adorned with sandal paste, necklaces and other ornaments. There is nothing to mark off the stage from the audience but a lighted lamp, and there is no curtain.

When everything is ready, the actor comes, stands facing the audience and performs *Mangala*, the verse being mixed Sanskrit and Malayalam, in a voice that is scarcely audible. This is then followed by a long prose passage in which he sets forth the purposes of such dramatic expositions, the main object being religious education of the easiest and simplest type. This opening verse and the subsequent prose passage compare very favourably with the *Nāndi* and *Prarocana* of the

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[1] This information is supplied by my esteemed colleague, Dr. Sen.

[2] Vide the Drama and Dramatic dances of non-European Races—Page 10.

Sanskrit stage. These over, he begins in the local vernacular and describes the situation where the story begins. Having thus well introduced the audience to the particular context, he recites the text which is in Sanskrit and proceeds to expound the same in vernacular with a wealth of illustrations, making adequate reference to the current social topics and not rarely to individuals. There is little of acting, but appropriate gestures are utilised to make the narration as vivid as possible. The expositor enjoys freedom of speech to a certain extent, though for fear of losing his patronage he never uses it to the same extent as the *Cākyār* does. It will be seen from what has been said that the main aim of this variety of spectacular entertainment is to impart education leavened with wit and humour.

This variety of entertainment is not far distinct from the variety of *Kūttu* called *Prabandham Kūttu*, for in both we have dramatic exposition and both serve more or less the same purpose. There are indeed some essential differences to which we shall refer later, and these would show that in *Pāṭhakam* we have *Prabandham Kūttu* in miniature. The prominence given to the local vernacular and the freedom given to the performance, the place of acting and the actor are evidently innovations introduced in the direction of simplification with a view to making it more and more popular. And well was it for our land that such a type of recreation came into existence; for, as a result of this, some of the light of Sanskrit learning illumined the minds of even the masses. From another point of view also one ought to be grateful to the originators of *Pāṭhakam*, for this has led to the creation of a number of works in Sanskrit which are locally called *Prabandhams*. In number they are over 30, and in size they may easily fill a volume of about 300 pages, while in intrinsic merit they occupy a very high place in literature. Here is a definite measure of Kerala contribution to Sanskrit Literature, but unfortunately it is as yet unknown and unjudged. It is strange that not one of these has yet been published in Devanagari script. Again the need for an expository commentary to help the *Pāṭhakakkāran* has also led to the creation of a school of literary criticism in Malabar and it also adds a definite contribution of its own to literary criticism. Thus it will be seen that *Pāṭhakam* and *Prabandham Kūttu* supplied not merely noble recreation to all alike, both the literate and illiterate but also enriched the Sanskrit Literature both by original works and valuable commentaries.

## (vii) Kathakaḷi

*Kathakaḷi*, the most important variety of our popular stage, is not a very old type of entertainment and the circumstances of its origin are well-known. One of the well-known Zamorins of Calicut organised what has now come to be known as *Kṛṣṇāṭṭam*, modelled probably on Jayadeva's *Gitagovinda*—a variety of our stage which we shall consider later. This became very popular as soon as it was organized, and a neighbouring chief requested the Zamorin to send the troupe to his court. But because they were political rivals, the lātter refused to send the troupe and sent word that there were none at the southern court who could appreciate the play. The chief retaliated by organising another popular variety of

entertainment, then called *Rāmanāṭṭām*, which subsequently has come to be called the well-known *Kathakaḷi* or *Āṭṭakatha*. Thus was organised by a chief of *Kottārakkdra Svarūpam*, a new type of entertainment which before long became the most important section of our local stage and which led to the creation of what constitutes the most substantial part of our vernacular literature. Thus this is one example of a political feud resulting in literary acquisition.

It is definitely known that *Kṛṣṇāṭṭam* was first staged on the date expressed in the Kali chronogram, '*Grāhyā stutirgathakaih*', which, when worked out, gives the date, approximately 1657 A.D. This would show that *Kathakaḷi* must have come into existence sometime later. We shall not be far from the truth, if we place this in the latter half of the 17th century. The same view is further borne out by the opening verse of *Ramanaṭṭam*, which runs as follows:

prāptānandaghanaśśriyaḥ priyatamā śrīrohiṇījanmanaḥ
Vanciksmāvaravīrakeralavibhoḥ rājnassvasussūnunā
śiṣyeṇa pravareṇa śaṅkarakaveḥ rāmāyaṇam varṇyate
kāruṇyena kathāguṇena kavayaḥ kurvantu tatkarmayoḥ.

This verse suggests that the prince of Koṭṭārakkara who is the author of this work was a nephew of Virakerala Varma of Travancore and a disciple of Śankarakavi. There appears to exist a prince of this name somewhere about 1665 A.D. It is therefore quite probable that this new variety must have been devised somewhere in the sixth decade of the 17th century.

It may not be uninteresting to point out briefly the nature of *Rāmanāṭṭam*. It describes the story of Śri Rama, beginning with Daśaratha's *Putrakāmeṣṭi* sacrifice and ending with the siege of Lanka. The costume of the characters was more or less based upon what obtained in *Kṛṣṇāṭṭam* and masks were worn. The whole play was divided into seven Acts, to be staged in seven days or a Seven Days Play, as is technically called, and was first staged in front of the Gaṇapati shrine at Koṭṭārakkara, the shrine of the family patron deity. Coming to the work itself, the language is a mixture of Sanskrit and Malayalam, the former predominating in the verses and the latter, in the *Padams*—a peculiar language feature which obtains also in the later *Kathakaḷi*. Critics are of opinion that the work does not possess a high order of literary merit; but however that may be, students of Malayalam Literature cannot afford to forget the services rendered by the prince of Koṭṭārakkara: for he originated the new type of spectacular entertainment which in its turn contributed a good deal to the literary status of Malayalam.

The legitimate and proud child of *Rāmanāṭṭam* is *Kathakaḷi*, which we shall now proceed to notice. As is usually the case, the play is generally announced by a *Keḷikoṭṭu*, and since elaborate get-up and costume are necessary for the various characters, the more important actors get to the green-room early in the evening. As in the Sanskrit dramas, there is the *Pūrvaranga* which consists in the recital of a few verses followed by some specific *steppings* behind the curtain. After this the curtain is lifted and the hero and the heroine of the play

make their appearance and perform *Mangala*. This constitutes what is called *Toṭayam-purappāṭu*, and it compares very favourably in almost all essential respects with the *Purvaranga* and the *Nāndi* of the Sanskrit Dramas. After this is over the play begins, the most prominent feature of which is, as we have mentioned, the use of the gesture language and the exquisite dancing and acting to the accompaniment of the music of the singer who also works on musical instruments. The play generally continues throughout the night, the more important characters appearing only towards the latter part of the night. The actors are generally Nairs, and rarely Brahmins, and they have to undergo a process of training for a period of not less than five years. The various poses, the supple dances and the clearness of facial expression, in these *Kathakaḷi* actors appear to satisfy the highest expectations of Bharata. They have attained almost perfection in the art of acting as expounded by Bharata. as well as in the art of the proper use of paints; yet they are not slavish imitators. Though Bharata has tabooed many an item from actual representation on the stage, such for instance as duels, deaths, feasts, kissing, embracing, etc., our actors never care for these restrictions: they represent these freely as on the modern stage.

The plot of the story is generally taken from that inexhaustible storehouse of Hindu mythology, the venerable Epics. It is to be regretted that no local heroes are dramatised, even though there were indeed a number of them, at that time at least, who achieved the highest eminence on account of the coming of the Portuguese and the consequent series of battles; yet our authors have introduced many innovations and changes in the Puranic stories which are intended either to remove practical difficulties of staging or to enhance the artistic effect of acting and afford scope for the presence of almost all the most important characters. The 'literary framework' of the plays is composed of three distinct elements. The *Pādams* or verses constitute the first of these and they are mainly Sanskrit in form and language, conforming more or less to the highly artificial nature of the classical language in the introduction of the various verbal figures such as assonance, alliteration and long compounds. But unlike those in Sanskrit dramas, these verses set the story in motion and serve as connecting links to bridge over the difficulty of time and space and in this respect they fulfil the function of the Shakespearian chorus as found in the Henry V. The verses are always sung and very seldom acted. The second is what are called *Daṇḍakams*, long pieces of rhythmic prose in mixed Sanskrit and Malayalam which serve more or less the same purpose as the verses. The third is called *Padams*, which are mainly in Malayalam and form the subject for acting. They are neither in the classical metres nor in the musical Dravidian metres, but in rhythmic prose obeying certain specific laws, and guided by musical quantity and notation based on the length of syllables. They are at the same time conversational in style and use the 'emphasis of sound to strengthen the emphasis of sense'. The *Padams* can be divided into many kinds based upon the subject matter, such as for instance erotic pieces, challenges, self-praise, messages, laudations, etc. The first of these consists of such pieces as describe the sunset, moonrise, etc. and their effect on the impassioned hero or heroine, and these are characterised by the slow moving steps, which in

local technique are known by the term *Patiññāṭṭam*, the movement of the piece and the acting generally agreeing with the rise and development of the passion. The *Padams* are fully as capable of expressing emotion and as efficacious in imaginative appeal as the *ślokas* but transcend them in musical effect. They are a splendid blending of music and poetry and thus, though they are to a certain extent lacking in naturalness, they are superior to the prose or 'loosened speeches' of the dramas. In spite of this want of a certain naturalness, they do serve their purpose almost to perfection. These three, namely *Pādams, Daṇḍakams and Padams*—constitute the literary framework of the *Kathakaḷi*. An examination of some of the well-known plays clearly tends to show that there are separate rescensions of the text, and this agrees with the tradition that there were originally two kinds of *Kathakaḷi*, the northern and southern variety, the one being popular in Northern districts of Malabar, and the other, in the South. This difference is not kept up now.

No account of this variety of our stage can be complete without a reference to the costume and get-up of the characters. When the entertainment was first devised and staged at the Gaṇapati shrine at Kottārakkara, the actors appeared in a very rudimentary costume. They did not apply paints, but instead wore masks painted over with red, dark and other pigments, and they never used any head-dress. The first change introduced in costume was by a prince of the *Veṭṭat Svarūpam*: he insisted that the actors must use facial paint, wear a head-dress and cover their body with something like a coat. A few changes were also introduced in the musical accompaniments. Originally the musicians were themselves the actors, at which time the *Cenda* was not used. The introduction of this musical instrument and a singer over and above the actors constituted the innovations introduced in the matter of stage accessories. The mode of representation thus inaugurated has come to be known as the *Veṭṭat Mode*. These are, indeed, changes important in their own way. For, the first of these is a very important one, in that the use of masks not only precluded all attempts at varied expression, but, necessarily tended to stereotype the passions portrayed and prevented the rapid manifestation of the change of passion'. The second set of changes, especially the introduction of a singer, enabled the actor to concentrate on the actual acting. For some time these were the only improvements effected, but later two *Nampūtiris* took up this study and by them the whole show was completely reorganised into what obtains now. One of the *Nampūtiris* belonged to the *Kaplingaṭ Mana* and the other, to the *Kallaṭikoṭu Mana* and both introduced some innovations of their own. The innovations made by the former are briefly the following: different costumes for different casts of characters, *Ālavaṭṭam* and *Veñcāmara* for the most important characters, in whom divine or regal splendour has to be emphasised; the mounting of a small *ball* on the tip of the nose of the *Asura* characters (See Pl. IV-i) and the application of *Cuṭṭis* for enhancing the effect of facial expression, some changes in the code of the gesture language, the nature of the various *steppings*, the painting of the face and the use of *Niṇam Aṇiyal*. These constituted the main innovations, and all these changes together constitute what is technically called the *Kaplingaṭ* or the *Northern Mode* of representation. The *Kallaṭikoṭu* or the *Southern*

*Mode* differs from the former in that it introduced some changes in the gesture language and the dancing steps, in the nature of music, Sangiti a *variety of tunes*, being introduced, etc. The essential difference between the two lies in the fact that while the former emphasised expressiveness of facial features and gestures, the latter brought into greater prominence dancing and dancing steps and made them aid expression. In the stage at the present day, both these modes are mingled together and as a result all the four items are adequately emphasised.

We shall now briefly notice the costume and get-up of the various characters. There are three types of characters that appear on the stage and they are (1) *Minukku*, (2) *Teppu*, and (3) *Tāṭi*. The second of these is again of two kinds: (*a*) *Pacca* and (*b*) *Katti*, while the third is again of three kinds: (*a*) *Kari* or *Karatta Tāṭi*, (*b*) *Vella Tāṭi* or *Velutta Tāṭi* and (*c*) *Cokanna Tāṭi*, which last, be it noted, is almost the most important character in almost all plays.

The first of these, i.e., *Minukku* (See Plate IV-i: the figure to the right) which literally means smoothening the face, is the simplest of the kind and consists of a simple powdering of the face with yellow and red pigment mixed together, adorned here and there with a few white dots. Black unguent is applied to the eyes and the lashes, while the white of the eyes and the lips are reddened by the application of what is called '*Cuṇḍappūvu*'. The forehead is sometimes adorned with a caste mark of the type called '*Gopi*'. This is generally the facial paint for the females, sages or saints and holy brahmins and minor characters.

*Pacca* is a slightly more elaborate form of facial paint. The facial front is painted in green, and it is given a white border about an inch in width running all round and touching the *Cuṭṭināṭa* in the forehead, which forms the base of the head-dress. The eyes and lashes and lips are dyed as before. A typical instance of this could be seen in the seated figure in Plate IV-ii. This facial painting is generally given to the hero or the *Nāyaka* of the play and such other characters as are princes and good men.

*Katti* (See Plate V-i.) is a still more elaborate form of facial paint, being an improvement on *Pacca*, in that there is within the bordered *Pacca* another *cuṭṭi* around the nose, while the space between this and the nose is kept red, the nose being green in colour. The red streak will be over ½ an inch in thickness and runs up either side of the nose to the forehead and over the brows. In addition to this there will be placed just at the tip of the nose a round ball called *Cuṭṭi-puvvu* which is white in colour. This figure generally presents a fierce character and is very impressive on the stage. This is the costume prescribed for *Pratināyaka* and those having an *Asura* tinge in their blood.

Still more elaborate and fierce looking is the costume prescribed for the characters, known as *Tāṭi*. *Tāṭi* style is of three kinds: (1) *Cokanna Tāṭi* or the red-beard; (2) *Velutta Tāṭi* or the white beard; and (3) the *Kari* or *Karutta Tāṭi* or the black beard, (see Plate V-ii the figure on the right). This differentiation is based on the colour of the beard worn by these characters which is an indispensable part of their costume. In this the *cuṭṭi* instead of circling round the nose and spreading out into

the fore-head runs around the eyes and reaches the Cuttinata, the ends of which together with the central part are adorned by *Cuṭṭipuvus*. The region of the eyes is painted with dark pigment. The other facial adornments are as before. A typical *Cokanna Tāṭi* is seen in Plate IV-i. This is the costume prescribed for proud and wicked characters who are bent upon doing evil things.

Such facial painting helps facial expression considerably, the colours of the paints and projections being devised with specific reference to the various *Rasas* and *Bhāvas* which predominate the various characters. *Kathakaḷi* is eminently a play in which the stronger or wilder passions have full play. The exceeding simplicity of the female characters constitutes in itself an evident proof of the minor part they are intended to play in the actual conduct of the play. It is also significant that even the female characters (See Plate V-i and ii the second figure from the right), when they have to discharge sterner acts, do appear in a garb more or less worthy of their function. Similarly, when love is depicted, it is always the sensuous and impassioned or the wounded and disappointed type. Thus it is always the strong passions that find expression in *Kathakaḷi* and the facial expression is such as will suit the strong, sensuous and intensified character of the passion; and naturally with a scientific eye for colour and effect, a variegated scheme has been introduced in facial paints, which agrees perfectly with the facial expression of the *Bhāvas*.

Quite consistent with the facial paint is the nature of the other items of costumes of which the most important are the head-dress, the breast-plate, the *Uttarīyam* and the skirt. There are two types of head-dress which are technically known as *Keśabhāram kirīṭam* and *Muṭi*. The first of these consists of a coronet surmounted by a circular disc. It is generally of two different types—a distinction based mainly on the size of the circular disc. The bigger one is generally used by confirmedly wicked characters (see Pl. IV-i the figure to the left) who are ferocious and have some sort of regal splendour, while the smaller kind is used by the other characters. Both these kinds of head-dress are used only by the male characters. The other variety of head-dress called *Muṭi* (See Plate IV-i the figure to the right) which corresponds to the coronet of hair of the sages and saints or the simple crown of kings, is generally worn by characters of a saintly disposition, sages and divine agents or allies, such as Hanuman, Nandikeśvara, etc. The head-dress worn by Śri Kṛṣṇa and Sri Rama are generally *Muṭi* adorned, however, with peacock feathers, instead of a spherical crown. At the base of the head-dress is tied what is called the *Cuṭṭināṭa* (see Plate IV-ii seated figure: the white line above the eyes) which forms as it were, the base from which springs the crown or coronet and which forms the white border completing the facial tattooing described before. The ears are adorned with two ornaments: *Kuṇḍalams*, a convex circular wooden disc adorned with paints and hanging down, for the lower portion, and *cevikkuttu*, a concave elongated disc, for the upper portion of the ear. Both these are worn by *Pacca* and *Cuṭṭi* varieties of characters. The female characters and *Tāṭi* generally wear only *Kuṇḍala*, also called *Tūkku*.

The dress for the body is simple, consisting mainly of what is called the *Koṭalāram*, the cover for the breast. It is a movable vest held in position by means of threads. The saintly characters generally have only garlands. Over this vest across the shoulders hang what are called *Uttarīyams*, one of which must be red in colour held in position by means of a *Keyūram* on the upper arm. There must be besides at least one more *Uttarīyam* of white, but the actual number will depend upon the importance of the character. The forearm is generally adorned with a *Kaṭakam* and above that are worn some *Valas*, or bangles. The upper arm (See Plate IV-ii seated figure) will have besides the *Keyūram* what may be termed a shoulder blade. In the case of the female characters, there will not be this shoulder blade nor the *Uttarīyam*, while the *Koṭalāram* will have false breasts adorned with garlands made of glass beads, while the waist is generally adorned by an ornate waistbelt.

The skirt, worn over drawers, is made of long pieces of cloth white in colour with borders adorned with lace work, (See Plate IV-i & ii). The pieces are over a foot in width and are strung closely, the whole being so arranged that while it forms a beautiful skirt, it gives absolute freedom of motion for the legs for acting and dancing. The two sides of the skirt are adorned with embroidered cloth (see Plate IV-i & ii) while in front hangs down what is termed a *Munti*, (See Plate IV-i the figure to the left). A leather strap, carrying belts, is tied on both the calf muscles, while at the ankles there is an ornate bandage as can be seen in Plate IV-ii.

Such, in brief, is the costume that the *Kathakaḷi* actors use. In devising it, ample consideration appears to have been bestowed to suit the costume to the accompaniments and accessories of the stage, which it must be remarked is to a great extent primitive. The heavy costume no doubt makes the actors more with slow and measured gait, but it does not preclude the possibility of quick change in pose and position; and it is quite in keeping with the stately dignity of the conception and practice of this variety of our local vernacular entertainment—something which is as well echoed in the measured cadence and movement of the highly finished and literary nature of the language. It deserves also to be pointed out that this elaborate, though stereotyped, costume is quite in keeping with the Hindu ideas of symbolic representation. It may not be quite happy from the realistic point of view; but as symbolising the conception of superior characters and of the free and natural play of Rasas and Bhavas, it can scarcely be said to be second to any. The very sight of a character reveals, as much as, if not more than, his action, the natural springs of his character and the innate motives of his actions. If to reveal the innate quality of the character through costume can be a source of success from the point of view of artistic conception, then our dramatists have indeed attained to a high degree of success in this branch of art; for even the most austere critic must perforce admit that the costume of the *Kathakaḷi* actor does reveal character.

Coming to the other accoutrements of the stage, reference deserves to be made only to the musical instruments. These consist of a *Ceṇḍa*, a *Cenkila* and *Elattāḷam*. *Ceṇḍa*, the popular drum, is a wooden cylinder

with two ends open and covered up with leather pieces. *Cenkila* is a metal plate which is sounded in unison with the drum and these two and the *Elattāḷam*, which is a bigger variety of cymbal are sounded to provide time to the acting and stepping which are done to the vocal music. There is also a curtain used which is held in position, when wanted, by two men stationed there for the purpose. As for the stage, there is nothing except a temporary shed put up above the actors, while the audience have all to sit down in the open yard. The only source of light is the big brass lamp kept in front of the actor with wicks in all the four directions. As has already been mentioned, the play is always open to the public.

## (viii) Conclusion

We have in the preceding sections referred to the more important varieties of our secular theatre. Before we conclude reference may also be made to two other varieties, *Poraṭṭu-Kaḷi* and modern dramas.

The former of these, *Poraṭṭu-Kaḷi*, is a variety of our theatre which has found great popularity among the lower orders of Hindus. The general features of the stage are more or less similar to those of *Kathakaḷi*; but there is considerable difference in matters of costume and general acting. In these matters it more or less tends to the modern type of dramas. But it is also different from this in that it is characterised by a complete absence of refinements of any kind. It appears that *Poraṭṭu-Kaḷi* is a variety of entertainment introduced from the East Coast, and consequently it has never risen to the aesthetic, literary or dramatic position of *Kathakaḷi*.

Coming to the field of modern drama, it has to be confessed that we have not much to our credit. The extreme popularity of *Kathakaḷi*, *Tuḷḷal*, etc. probably stood in the way of the development of the modern type of dramas. This evidently is a later growth, probably not more than a generation old and it has had two distinct stages in its development. In the first period of growth, it was modelled upon the Tamil drama with plenty of music and scenic equipment with but little of real acting. This has had a short spell of existence. The spread of English education brought with it a knowledge of the modern stage and a development of that sort of literature, known as the Novel. When once the latter became popular, scenes from well-known novels began to be staged. Besides, a number of farces, portraying current social life, have been produced evidently for the purpose of the stage. Year after year farces are being produced, but so far they have had only an ephemeral existence. It appears more or less that in the field of modern drama our development lies in the direction of prose-drama. Amongst the novels that have lent themselves to the purposes of the stage, the most important are Mr. Candu Menon's *Indu Lekha*, our first and greatest social novel, Mr. C. V. R. Pillai's *Marthanda Varmā*, the great historical novel, and H. H. Rama Varma Appan Thampuram's *Bhūtarāyar*, the greatest novel of the day.

Enough has now been said to show that Kerala has as much variety in the secular department of her theatre as she has in the religious department. Of these *Kathakaḷi* and *Tuḷḷal* are the most important both

from the literary and dramatic points of view, and these are peculiarly Malayali in spirit, in conception and in practice. Both these again have their origin in a quarrel and that with semi-religious Sanskrit varieties: *Kathakaḷi* is the off-shoot of a quarrel over *Kṛṣṇāṭṭam*, and *Tuḷḷal* of a quarrel with *Cākyār* acting a *Prabandham Kūttu*. And both have alike tended to the enrichment of our vernacular literature. To the student of dramaturgy, *Kathakaḷi* has its own particular appeal to make and interest to yield. Apart from the code of gesture language it has evolved for its own purposes, herein may be seen almost the highest perfection of the arts of acting and dancing, the perfect realisation as yet known of the technique so scientifically elaborated and described by Bharata in his *Nāṭyā Sāstra*. And these two constitute our richest heritage in the field of our stage and literature.[1]

[1] The information presented here is mainly based on oral sources. Different local variations also might exist. Any suggestions will be thankfully received.

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# UNIVERSITY PUBLICATIONS

| *Names of Publications* | *Price.* Rs. A. P. | *Where available* |
|---|---|---|
| 1. Factory Labour in India— By Prof. A. Mukhtar | .. 3 0 0 | The Secretary, The Students' Co-operative Society, Annamalainagar. |
| The University Journal Published by the University. Annual Subscription | .. 4 0 0 | The Editor, The University Journal, Annamalainagar. |
| The Annamalai University Miscellany. Per issue | .. 1 0 0 | The Editor, The Annamalai University Miscellany Annamalainagar. |

**RECENT PUBLICATIONS.**

| | | |
|---|---|---|
| 2. Bhoja Raja— By Prof. P. T. Srinivasa Ayyangar | .. 1 8 0 | The Secretary, The Students' Co-operative Society, Annamalainagar. |
| 3. Swaramelakalanidhi— By Mr. M. S. Ramaswami Ayyar | .. 2 0 0 | Do. |

## University Notes

CONVOCATION :—

The first Annual Convocation for the purpose of conferring degrees was held on Tuesday, the 27th October, 1931, and was presided over by His Excellency the Rt. Hon'ble Lt.-Col. Sir George Frederick Stanley, P.C., G.C.I.E., C.M.G., Governor of Madras, and Chancellor of the University. M.R.Ry. Rao Bahadur S. E. Runganadhan Avl., M.A., I.E.S., the Vice-Chancellor of the University delivered the Convocation Address which we print elsewhere. The Degree of Bachelor of Arts was conferred on 28 candidates.

* * *

The Vice-Chancellor, Rao Bahadur S. E. Runganadhan, represented the University at the Congress of the Universities of the British Empire, where he took an active and valuable part in the deliberations of the Conference.

* * *

During the year under report, the University was represented by the following members of the Teaching Staff at the several Conferences.

1. Dr. B. V. Narayanaswami Naidu, M.A., B.COM., PH.D., Bar-at-Law.—The All-India Economic Conference at Bombay.
2. Dr. Saileswar Sen, M.A., D. Litt-et-Phil.—The Indian Philosophical Conference at Patna.
3. Mr. A. Narasinga Rao, M.A. and Mr. S. Sivasankaranarayana Pillai, M.Sc.—The Indian Mathematical Conference at Trivandrum.
4. Mr. C. S. Srinivasachari.—The Bombay Historical Congress.

* * *

The following special lectures were delivered during the year.

1. Brahma Sri Mahamahopadyaya Vidya Vachaspathi S. Kuppuswami Sastri, Professor of Sanskrit, the Presidency College "Highways and Byways of Literary Criticism in Sanskrit"—Two lectures.
2. Mr. O. C. Gangoli—"Indian Fine Art"—Three Lectures.
3. Professor Sir S. Radhakrishnan—"Religion in the Modern World"—Three Lectures.
4. Dr. B. B. Dey, Professor of Chemistry—"Enzymes"—Three Lectures.
5. Mr. Lakshmana Sarma—"Health and Hygiene"—Three Lectures.
6. Mr. M. S. Ramaswami Ayyar—"Music then and now—Landmarks in the History of Indian Music"—Five Lectures.

7. Mr. S. S. Suryanarayana Sastri, Reader in Philosophy, Madras University—"The Illusoriness of the World of Difference; The Relation of the Jiva to Brahman; The Nature of Release: the Place of Happiness in Brahman; The Nature of Release—Jivan Mukthi".—Four Lectures.

* * *

The Regulations embodying the revised courses of study leading to the B.A. and B.Sc. Degrees were passed by the Academic Council and given effect to from the academic year 1931–32.

Provision has been made for instruction in the following subjects under Part III, Optionals of the B.A. and B.Sc. Degree courses:— English, Philosophy, History, Economics, Mathematics, Chemistry, Physics, Sanskrit, and Tamil.

* * *

A unique venture has been made in starting the B.A. (Honours) course in Tamil.

The Syndicate has decided to award a money prize of Rs. 1,000 to the author of the best book in Tamil on 'Logic,' suitable for use in the Intermediate Class.

The appointment of a Telugu Pandit has been sanctioned from the academic year 1932-33, with a view to enabling students to offer that language under Part II of the B.A., and B.Sc. Degree courses.

The Honours course in Chemistry was begun in July last. The only other institution with such a course in the Madras Presidency is the Presidency College, Madras.

* * *

A department of Natural Science (Botany and Zoology) has been started.

* * *

RESEARCH DEGREES:—

Two Research Degrees, M.Litt. and M.Sc. have been instituted. The degree will be granted on the basis of a thesis which shall be a record of research carried on at the University for a period of not less than one year in the case of B.A. (Honours) or B.Sc. (Honours) and two years in the case of those with B.A. or B.Sc. Degrees.

* * *

The Rajah Annamalai Music College and the Oriental Pandits' Training College will be incorporated into the University from the academic year 1932-33. The Founder has generously given an endowment for the purpose.

* * *

The rapid extension of the Library is being steadily continued by the authorities, Rs. 48,000 having been sanctioned for the purpose during the past year. The Pro-Chancellor has generously given 806 volumes to the Library.

* * *

Higher studies and research have been pursued by the members of the Staff, several papers having been published in various technical and scientific journals. A large number of Extension Lectures have been delivered by members of the Staff.

* * *

The following members were deputed for specialised training:—

The Director of Physical Education to take special training in Indigenous Systems of Exercise at the Madras Shivaji Vyayam Mandal;

Mr. G. V. Krishnaswami Ayyangar to the Kodaikanal Observatory.

In addition Dr. M. O. Thomas was granted leave to go to England to undergo training in "Library Science course."

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The second 'Founder's Day' was celebrated on the 13th of October, 1931 when Mr. S. Satyamurthi delivered the address, and Mr. M. Ratnaswami, M.A. (Cantab.), C.I.E. presided.

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Kumara Rajah M. A. Muthiah Chettiar of Chettinad, B.A., M.L.C., has given an endowment of Rs. 1,000, the interest on which is to be utilised annually for a prize.

REVIEWS

## Shivaji, the Founder of Maratha Swaraj


By

Mr. C. V. Vaidya



*B. I. S. M. Puraskrita Granthamala, No.* 26—*Poona*, 1931, *published by the Author, at* 314, *Sadashivpeth, Poona City*—*pp.* 410—*price Rs.* 3.


No great justification is needed for the addition of yet another book on Shivaji's life and its significance. The first-hand sources of information for the subject are still in the process of being sifted and gathered. The Shiva Charitra Kāryālaya and the Bhārata Itihāsa Sanshodaka Mandala of Poona have been doing yeoman service in this matter in recent years. It is, of course, a vexing and difficult task to evaluate the relative values of the different sources, papers, *Khaifiyats, sanads*, correspondence of the European settlements, Muhammadan writings, etc. The exhaustiveness of the material collected is not, in this subject, more important than the correct and rational interpretation and presentation of the same. Mr. Vaidya, the doyen of the present-day Maratha historians and scholars, holds that the life of Shivaji is best written by an admirer and a country-man of his, who should, however, restrain his impulses and take an impartial attitude in the judging of moral and political justifications. The author thus rightly maintains that the *Bhakarkars* have exaggerated their hero in as large a measure as he has been misrepresented by hostile writers. In this particular, the poetical fulness and richness of the *Shiva-Bharata* is attempted to be reduced to its proper level in the required places. The value of some of its suggestive observations is well brought out; thus, we are told with reference to Shivaji's acquisition of Javali, from an extract from it, that "whoever has Javali has Wai *prant*, the whole range of Sahayadri and the corresponding sea-coast." The explanation is given for the discrepant dates of Shivaji's birth that the *Bhakarkars* concocted a hero's horoscope for Shivaji, with five planets in the *uchcha*, that the planets were not so in 1630, and they were roughly so in 1627. It is also suggested by the author that, perhaps, the *Bhakarkars*, wrongly caught hold of one of the brothers of Shivaji; but he adds the caution that the controversy cannot be regarded as finally settled, unless evidence is forthcoming of a contemporary character.

The *Muhammad Nāma*, a copy of which was recently discovered by Sir J. N. Sarkar, from the Kapurthala Library, was a contemporary account of Muhammad Adil Shah (1627–1656), and, most likely, one of the sources of the *Basātinu's-Salātin*, which has been till now regarded as the only good book for the history of the Adil Shahi Dynasty. It has been utilised for the chapter on the imprisonment and release of Shahaji in 1649, as a supplement to the *Shiva-Bharata* and the *Jedhe Sakhavali* and the recent publication of the collection known as the *Shivakālin-Patra-Sāra Sangraha*. The *Bhakarkars* held, rightly in

the author's estimate, as regards the Afzal Khan affair, that "Shivaji knew what was in his opponent's heart and he knew what was in Shivaji's; and God alone knew what was in the mind of fate" and that destiny declared its decree, though the historian may try to explain the incident with reasons. Mr. Vaidya examines the different versions of Shivaji's surprise attack on Shayista Khan's camp; of these the earliest and the clearest contemporary account is the Rajapur English letter, dated 12th April, 1663; and the story of Grant-Duff's is the last and the strangest version, mainly gathered from the later Bhakarst Professor Pisurlenkar and others have shown, from the letters of the European settlements, that Shivaji was looked upon as an independent monarch even as early as 1663 and his rise had come to be regarded as a Hindu movement. His sack of Surat in 1664 was, on the testimony of the English and Dutch factors of the place, not marked by "needless and excessive" cruelty. Mr. Vaidya would also exculpate Raja Jai Singh of Amber from the charge of having been privy to any pre-planned plot against Shivaji, during the latter's visit to Agra, but would add that it is impossible to state definitely that he was honest (p. 188). He holds that the descent of the Bhonsles from the Sessodias of Udaipur had always been accepted and there was no necessity for concocting a new Kshatriya pedigree at the time of Shivaji's coronation, as had been suggested by some writers on the basis of the later *Bhakars*. Shivaji had already styled himself *Maharaja* and *Chhatrapati*, ever since his escape from Agra, in important state-documents and *sanads*. Of course one cannot wholly agree with the naive conclusion of the author that the establishment, by Shivaji, of Maratha rule in the Karnatak was completely and easily justified, being an extension of Hindavi Swaraj, though not Maratha Swaraj, nor with the statement that Hindu Marathas had a better right than the Muhammadans and the English to establish their rule in the Karnatak.

It will swell the length of this small review too much, if Shivaji's character, as examined in the book, is to be detailed and criticised; but very few will disagree with the stand-point taken with reference to his capacity, character and good traits. Much has been made of his alleged acts of deceit and treachery; and now the reaction from the previous unfavourable estimate is in full swing. Mr. Vaidya compares him, curiously enough, with Sultan Mahmud of Ghazni, though the accurate studies, recently brought out, of the *Bhūtshikan* Sultan by Messrs. Habib and Nazim will make the reader disagree with the Maratha biographer in the happiness, as well as the propriety, of the analogy he institutes. Making due allowances for justifiable pride and estimates of a favourably disposed temper and understanding, Mr. Vaidya's book sustains the claim that it makes of being a full, patriotic and withal, impartial estimate of the great Maratha Hero. The small blemishes in printing and the peculiar spelling of Mughal and other names adopted, are minor defects which can be removed in a subsequent edition.

C. S. SRINIVASACHARI.

# Bhoja Raja

BY

PROF. P. T. SRINIVASA AIYANGAR, M.A.,

(*Annamalai University Historical Series, No. I.* 1931.)

Among the older generation of Indian Indologists the late lamented Professor P. T. Srinivasa Aiyangar held a unique place, first as an anthropologist and next as an historian. Author of several books, the learned Professor endeared himself to the scholarly, and even the lay world by his inimitable flowing style, and sometimes by his original and thought-provoking theories. It may be we agree with his views or not. But what the critical student admires in him is his boldness and assertiveness, characteristics of a born researcher. His was not a realm of doubt. To him either a certain thing was a fact or a fiction.

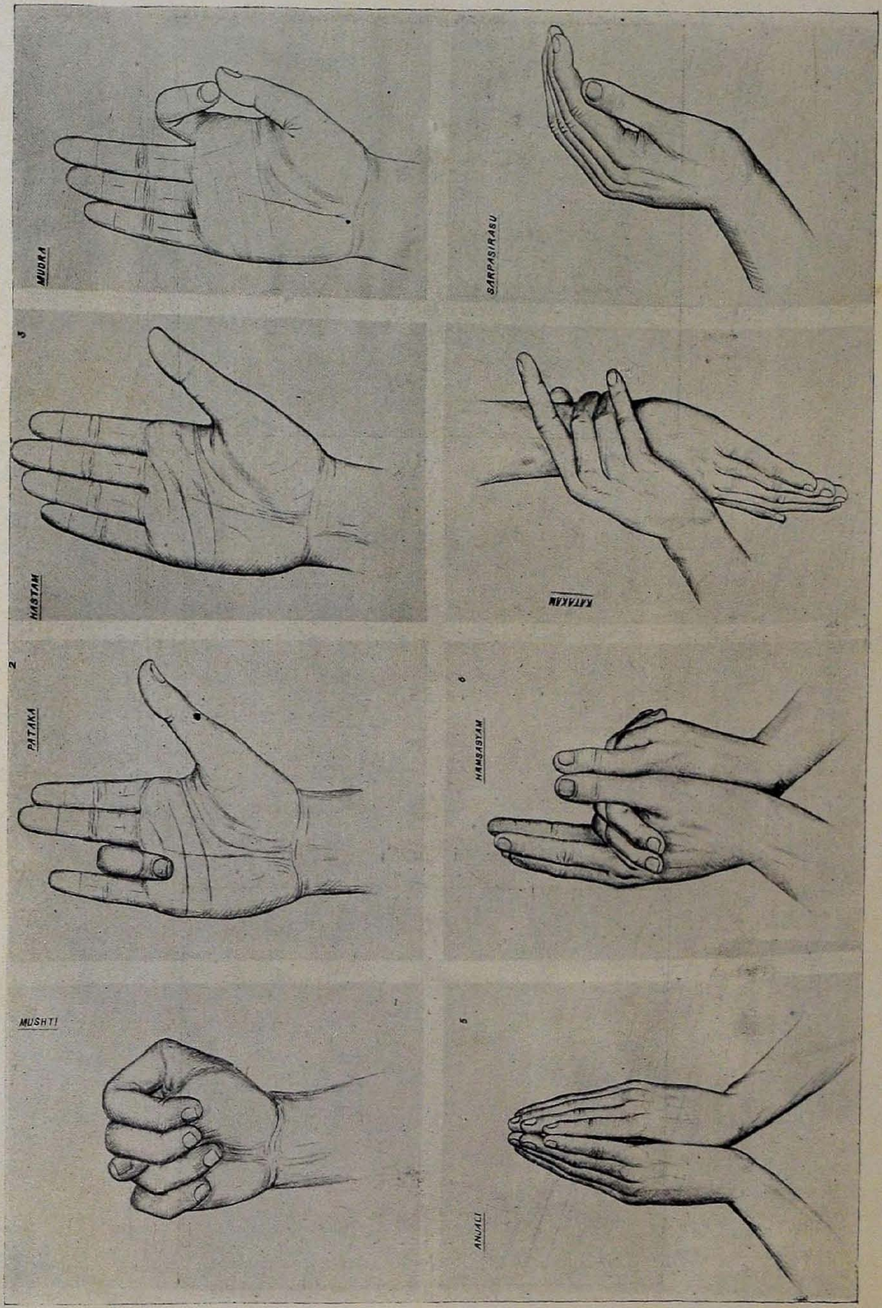
The book under review forms the first of the Annamalai University Historical Series, but, unfortunately, the last of the published works of the late Srinivasa Aiyangar. The subject of this excellent monograph is a critical study of the life and career of that ruler of India, Bhoja of Dhārā, whose heroic valour, coupled with a princely generosity, was a model for kings of all time to follow. The book is divided into ten chapters of which the first three give an account of Mālva and its early history and of the Paramāras. The last two chapters are devoted to an examination of the social and religious life in the times of Bhoja as well as of his monuments. Five chapters deal with the personality, character and achievements of Bhoja. In this study the stand-point of Mr. Srinivasa Aiyangar is that of the historian. Every available source of information, including inscriptions, tradition, and literature has been pressed into service; and in the use of his materials, he has combined discrimination with sober judgment. We are sure that his critical estimate of Bhoja, and a general picture of the eleventh century India, will be found widely acceptable by all students of history. The value of the monograph is much enhanced by a number of plates, of which special mention may be made of the idol of Sarasvatī, enshrined in Bhoja's Temple of Śārāda and the *Sarpa Bandha* (serpentine) inscriptions. The index is copious and useful.

Last, but not least, the book is appropriately dedicated to Rājah Sir S. Rm. Annamalai Chettiar, Kt., the Founder-Pro-Chancellor of the Annāmalai University, who has been 'helping the ancient culture of India to keep growing on from more to more.'

V. R. R. DIKSHITAR.

Methodist Publishing House, Madras—1932

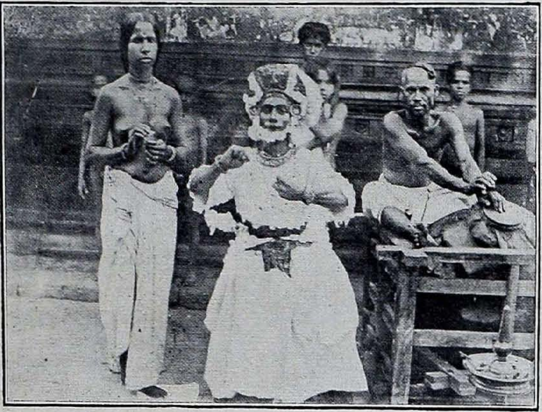
PLATE I. Some Typical Mudrās.



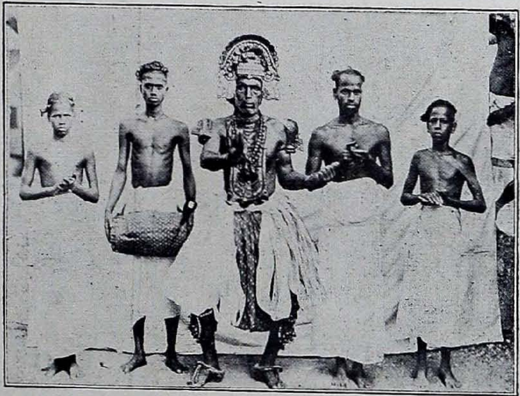

(Through the courtesy of the Superintendent of Archaeology, Trivandrum.)

PLATE II.

(i) Prabandham Kūttu.



(ii) Tuḷḷal.

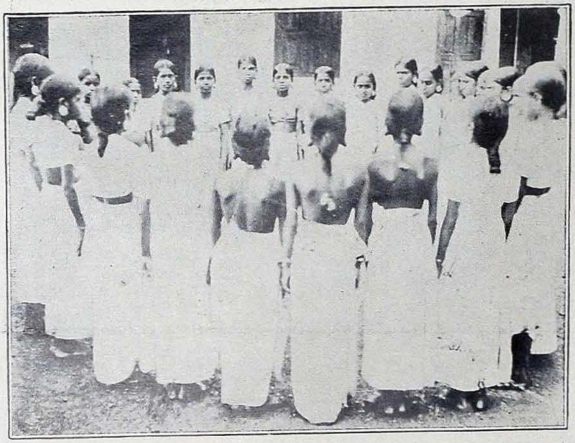


(Through the courtesy of the Honorary Superintendent, The State Museum, Trichur.)

PLATE III.

(i) Korattiyāṭṭam.

(ii) Kayyukoṭṭikaḷi.



(Through the courtesy of The Honorary Superintendent, The State Museum, Trichur.)

PLATE IV.

(i) Cokanna Tāṭi.

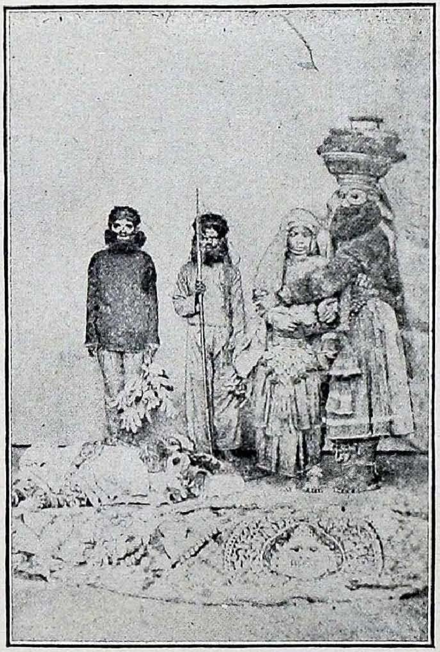
(ii) Pacca.

(Through the courtesy of the Sarvadhikariakar to His Highness the Maharaja of Cochin.)

PLATE V.

(i) Katti.

(ii) Kari.



(Through the courtesy of the Sarvadhikariakar to His Highness the Maharaja of Cochin.)

**For favour of Review and Exchange**